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Barriers to trade and labour mobility in conflict-affected regions: an economy-wide analysis with applications to the Palestinian economy

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To

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List of abbreviations

CES	: Constant Elasticity of Substitution
CET	: Constant Elasticity of Transformation
CGE	: Computable General Equilibrium
COGAT	: Coordination of Government Activities in the Territories
CPI	: Consumer Price Index
EFTA	: European Free Trade Area
EU	: European Union
EV	: Equivalent Variation
FTA	: Free Trade Agreement
GAFTA	: Great Arab Free Trade Area
GAMS	: General Algebraic Modelling System
GATS	: General Agreement on Trade in Services
GATT	: General Agreement on Tariffs and Trade
GDP	: Gross National Product
GNI	: Gross National Income
ICSE	: International Classification of Status in Employment
ILO	: International Labour Organisation
IMF	: International Monetary Fund
IOT	: Input-Output Tables
ISCO	: International Standard Classification of Occupations
ISIC	: International Standard Industrial Classification
LES	: Linear Expenditure System
LFS	: Labour Force Survey
MAS	: Palestinian Economic Policy Research Institute
MFN	: Most-favoured-nation
MoF	: Ministry of Finance (Palestine)
NA	: National Accounts
NPISH	: Non-Profit Institutions Serving Households
PECS	: Palestinian Expenditure and Consumption Survey
PCBS	: Palestinian Central Bureau of Statistics
PIPA	: Palestinian Investment Promotion Agency
PLO	: Palestinian Liberation Organisation
PMA	: Palestinian Monetary Authority
PNA	: Palestinian National Authority
PPI	: Producer Price Index

PTA	: Preferential Trade Agreement
OECD	: Organisation for Economic Cooperation and Development
SAM	: Social Accounting Matrix
SNA	: Systems of National Accounts
STAGE	: Static Applied General Equilibriun
SUT	: Supply and Use Table
UNCTAD	: United Nations Conference on Trade and Development
UNComtrade	: United Nations Commodity Trade Statistics
USA	: United States of America
WTO	: World Trade Organisation

SUMMARY AND ZUSAMMENFASSUNG

Summary

Barriers to the movement of goods, services and labour are used by states to signal their resolve in political conflicts. Although the outcome of such barriers negatively affects both the sanctioning and sanctioned economies, the burden can be particularly high for small economies with few trading partners and a small number of traded commodities.

In the case of the Palestinian-Israeli conflict, the asymmetry of power between the two parties leaves the Palestinian economy vulnerable to policies implemented by Israel. Of particular interest are the closure policy and work permit scheme which render the labour markets in Palestine subject to substantial fluctuations when the access of Palestinian labour to the Israeli market is changed by a legislative fiat.

With respect to trade, the 1994 agreement on economic relations between the two parties – assumed to enable a trade-led growth of the Palestinian economy – provides the Palestinian National Authority (PNA) only with limited policy space. Consequently, the one-sided customs union with Israel and the relative isolation of Palestine from international markets led the Palestinian economy to evolve into a captive market for the Israeli products. Palestinian production for the domestic market is undercut by the economies of scale realised by the technologically advanced Israeli manufacturers. Moreover, the development of a productive capacity in Palestine is held back by restrictions and regulations of different sorts imposed on the Palestinian entrepreneurs by the Israeli administration.

While the Palestinian-Israeli conflict attracts considerable media attention for its violence and political developments, the assessment of the economy-wide implications of policy options in the areas of trade and labour markets on the Palestinian economy is understudied. Most of the previous studies either used a descriptive analysis or highly aggregated databases which are unable to provide a detailed analysis of the multiple implications of the simulated policies. Therefore, this thesis aims at the following five research objectives:

1. Develop a detailed database to use in simulation models for assessing the economy-wide effects of policies in Palestine and more specifically in the West Bank;
2. Identify the model specifications that capture the labour markets conditions in the West Bank and quantify their implications for the simulation results;
3. Analyse the short-term effects of changes in the employment of Palestinians in Israel on the West Bank economy;
4. Assess the long-term implications of increased employment of Palestinians in Israel on the West Bank economy;
5. Investigate the effects of changes in the trade regime on the West Bank economy.

Each of these research objectives is addressed in a separate chapter of the thesis. As the West Bank is the only Palestinian territory having official trade with Israel and workers employed in the Israeli labour market since the Gaza blockade in 2007, the database developed and the simulations implemented focus only on the West Bank.

The method used in this thesis to capture the economy-wide effects of policy changes is the computable general equilibrium (CGE) class of simulation models. Starting from a standard CGE model (STAGE-2), this thesis contributes to model development by adopting a nested utility function combining the benefits of linear expenditure systems and constant elasticity of substitution functions to depict household preferences. Moreover, the trade and production modules of the model have been extended in order to depict the particularities of the West Bank economy and enhance the relevance of the simulation results to inform policies. The other contributions of this thesis to science are the following:

West Bank Social Accounting Matrix (SAM)

This thesis contributes to data development by building the first social accounting matrix (SAM) for the West Bank. This SAM is highly disaggregated to allow its future users to adopt alternative classifications depending on the research question. Among its distinctive features, this SAM takes proper account of the remuneration of labour for the self-employed and unlike most of the existing SAMs, it recognises that households derive income from unincorporated capital. This SAM is based on the most reliable and recent data for the West Bank. Its base year, 2011, can be considered a year of relative stability which can serve as a benchmark for simulation models.

Assessing the implications of different labour market conditions

This thesis makes a contribution to the current state of knowledge by assessing empirically the implications of different labour market conditions in CGE models. The four stylized model specifications investigated are: the fixed labour supply (full employment), the surplus labour, the upward-sloping labour supply curve and the labour-leisure trade-off.

Among the four specifications, the upward-sloping labour supply curve is not neutral to welfare generated outside the System of National Accounts (SNA) production boundary because labour enters the SNA boundary at a positive price but has a zero opportunity cost outside this boundary.

The fixed supply specification, while neutral to welfare generated outside the production boundary, assumes a strict separability between uses of labour within and outside the boundary. Hence, the supply of labour to market activities – i.e. the activities within the boundary – is perfectly inelastic. This specification does not fit the analysis of the effects of the Palestinian employment in Israel which involves a transfer of labour across the boundary as shown in several empirical studies.

Between the two remaining specifications, the surplus labour specification is suitable to represent the labour market conditions in the West Bank in the short-term. While this specification is likely to overstate the policy effects on employment, absorption and welfare, it captures well the empirical evidence of involuntary unemployment in the West Bank since the outbreak of the second Palestinian uprising. This involuntary unemployment is caused by the volatility of Palestinian employment in Israel and the inability of the domestic market to absorb in the short-term large numbers of workers, due to its small size.

For assessing the long-term effects of Palestinian employment in Israel, a labour-leisure trade-off specification is suitable because it explicitly accounts for welfare changes within and outside the production boundary. Moreover, in the long-term, labour markets are assumed flexible and labour can be employed either in the market or non-market activities. Therefore, on the long-term, no involuntary unemployment is assumed. Nevertheless, the labour-leisure trade-off specification allows the transfer of labour between the market and non-market activities which is expected to occur when the level of Palestinian employment in Israel changes.

After reaching these conclusions, the effects of changes in the Palestinian employment level in Israel are assessed from both short and long-term perspectives.

Short and long-term effects of changes in the employment of Palestinians in Israel

The findings show that a revert of the Palestinian employment in Israel to its *pre-intifada* level – i.e. reduced barriers to labour movement between the two regions – has positive effects on the West Bank economy in the short-term. The shock absorbs a substantial share of the unemployed labour, and stimulates both consumption and production in the West Bank economy. Labour moves out of unemployment to start working not only in the Israeli market, but also in the domestic market. Subsequently, the unemployment rate falls from 17.3% to 10.9%, and the West Bank economy grows as reflected in the real GDP increase by 3.6%. In addition, household welfare improves by 5.5% on average.

By contrast, in the long-term, the “Dutch disease” effects of increased Palestinian employment in Israel dominate the scene. The additional inflow of labour income from Israel reduces incentives to work inside the production boundary by increasing the demand for non-market commodities, i.e. the services produced by activities outside the production boundary. Labour is relocated away from the market activities and a real appreciation of the domestic currency reduces the competitiveness of the West Bank export industry in the international markets. Domestic output in the West Bank declines by 2.1% on average. The manufacturing sector is the most affected by the real appreciation of the domestic currency as it is the leading export sector in the West Bank. This finding highlights the trade-off between exporting more labour to Israel and exporting more goods and services to the rest of the world. Ultimately, the West Bank economy shrinks, as real GDP declines by 1.1%. However, the increased labour income from Israel allows households to consume more goods and services, and to experience a welfare gain of 1.8% on average.

This thesis shows that an increased Palestinian employment in Israel improves household welfare in both the short- and long-term. While in the short-term, it stimulates both consumption and production in the West Bank, in the long-term it reduces the economic growth by bidding up wages and reducing the competitiveness of the West Bank export industry in the international markets. Subsequently, policymakers would be recommended to aim at keeping the welfare gains of increased Palestinian employment in Israel, while reducing its "Dutch disease" negative effects on domestic production.

Palestinian future trade regime

The results show that eliminating tariffs on imports from all trade partners outperforms the other trade regimes considered regarding the positive welfare effects. Liberalising the West Bank trade improves all macroeconomic indicators as compared to the *status quo* of a continued customs union with Israel. The results also show that Israel will remain the dominant trade partner of the West Bank. Subsequently, introducing new tariffs on imports from Israel hurts the West Bank economy and generates an outcome that is worse than a continued customs union with Israel. Therefore, a preferential trade agreement with Israel, though worse than the current *status quo*, is more desirable than trading with Israel under the most-favoured-nation trade regime that would introduce high taxes on imports/exports from/to Israel.

Although a greater integration of the West Bank with other Arab countries is important, it cannot be a substitute to the economic link with Israel since Israel will remain, for both economic and geographic reasons, the main outlet for Palestinian trade.

The results also show that eliminating the in-quota tariffs in the West Bank hardly affects the import of agricultural and food products, as the import quotas become binding. Subsequently, the domestic agricultural and food sectors are shielded against import competition. However, doubling the import quotas improves consumer welfare, though it reduces the producer welfare. Thus, the net effect is a welfare gain in the West Bank. This finding highlights the trade-off between food sovereignty and net welfare improvement through trade. Finally, the results show that monetary policies have a substantial impact on the magnitude of trade policy effects.

Policy implications

This thesis identifies administrative and political options for the PNA to regulate labour markets and design an optimal trade regime.

With respect to the labour markets, considering the limited development options in the West Bank, it may be interesting for the PNA to seek increased Palestinian employment in Israel in order to improve the welfare of Palestinian households. However, the "Dutch disease" effects of labour income inflow from Israel on the domestic economy need to be mitigated. To do so, the PNA could collect a tax on Palestinian workers employed in Israel and use the tax revenue to incentivise domestic employers to invest in order to restore their competitiveness in the international markets. The tax would also reduce the attractiveness of employment in Israel, keep workers in domestic market activities and limit the structural dependence on the Israeli labour market. By fostering employment opportunities in the domestic market through the incentives given to the private sector, the eventual loss in Palestinian employment in Israel – subsequent to the implementation of the tax – could be compensated by the employment opportunities created in the domestic market.

With respect to the optimal trade regime, this thesis shows that the West Bank would be better off with a liberal and non-discriminatory trade policy. The results also show that Israel is likely to remain the dominant trade partner for the West Bank. Therefore, the PNA may want to pursue the freest possible movement of goods and services between the West Bank and Israel. The results show that changes in the exchange rate regime have strong implications for the magnitude of the effects of any trade policy. Subsequently, the PNA may seek the fullest control over its national currency and exchange rate in the future. Finally, the tariff-rate-quota system on agricultural and food products effectively shields those domestic sectors against import competition, but at the cost of consumer welfare. Hence, maintaining the system or changing the tariff-rate-quotas is a political choice between achieving a certain level of food sovereignty or taking advantage of trade benefits.

Zusammenfassung

Zu Beginn eines Konfliktes werden der Handel von Gütern und Dienstleistungen sowie die Mobilität von Arbeitskräften gestört. Oft werden Handels- und Mobilitätshemmnisse von Staaten als Druckmittel genutzt, um ihre Entschlossenheit in einem politischen Konflikt zu signalisieren. Die Folgen dieser Hemmnisse beeinflussen sowohl die sanktionierenden als auch die sanktionierten Volkswirtschaften negativ, stellen dabei aber insbesondere für kleine Volkswirtschaften eine sehr große Belastung dar. Das Hauptziel der vorliegenden Arbeit besteht darin, die Auswirkungen von Veränderungen auf Güter-, Dienstleistungs- und Arbeitsmärkten auf die Ökonomie in von Konflikten betroffenen Regionen zu untersuchen. Der Fokus liegt hierbei auf kleinen und engreifbaren Volkswirtschaften.

Als Fallstudie für diese Arbeit dient der palästinensisch-israelische Konflikt. In diesem Konflikt macht die Machtasymmetrie zwischen den beiden Parteien die palästinensische Wirtschaft anfällig für Handelsbarrieren und Sicherheitsmaßnahmen durch die israelische Regierung. Von besonderem Interesse sind die Mitte der neunziger Jahre von Israel eingeführten politischen Maßnahmen zur temporären Grenzschließung und der Vergabe von Arbeitserlaubnissen, die den natürlichen Fluss von Arbeitskraft, Gütern und Dienstleistungen zwischen den beiden Regionen wirkungsvoll verändert haben. Darüber hinaus hat die 1994 von den beiden Konfliktparteien unterzeichnete Vereinbarung über Wirtschaftsbeziehungen, die darauf abzielte, der palästinensischen Wirtschaft Wachstum zu ermöglichen, der palästinensischen Autonomiebehörde (PA) nur begrenzten politischen Spielraum gelassen. Infolgedessen sind die Arbeitsmärkte in den palästinensischen Autonomiegebieten verzerrt und unterliegen erheblichen Schwankungen, welche eng mit den Veränderungen des Zugangs von palästinensischen Arbeitnehmern zum israelischen Arbeitsmarkt zusammenhängen.

In Bezug auf Handel hat die einseitige Zollunion mit Israel und die relative Isolation der palästinensischen Autonomiegebiete von den Weltmärkten durch die israelischen Politik dazu geführt, dass die palästinensische Wirtschaft zu einem monopolistischen Markt für israelische Produkte geworden ist. Die palästinensische Produktion für den lokalen Markt wird durch Skaleneffekte der fortschrittlicheren Produktion in Israel unterhöhlt. Darüber hinaus wird die Entwicklung der Produktionskapazität in der palästinensischen Wirtschaft durch Restriktionen und Regelungen verschiedener Art behindert, die die israelische Regierung palästinensischen Unternehmern auferlegt. Daher macht das Handelsdefizit mit Israel allein zwei Drittel des gesamten palästinensischen Handelsdefizits aus, auf das fast die Hälfte des nationalen BIP entfällt.

Während der israelisch-palästinensische Konflikt wegen seiner Gewalt, seines historischen Hintergrunds und seiner diplomatischen Entwicklungen in den Medien viel Aufmerksamkeit erhält, ist die Bewertung der makroökonomischen Auswirkungen politischer Optionen in den Bereichen Handel und Arbeitsmärkte auf die palästinensische Ökonomie wenig untersucht. Die meisten der früheren Studien, die sich mit diesen Fragen befassten, verwendeten entweder deskriptive Analysen oder Methoden, die die gesamtwirtschaftliche Wirkung der jeweils untersuchten Politik nicht darstellten. Die wenigen Studien, die versucht haben, die gesamtwirtschaftlichen Auswirkungen der politischen Maßnahmen in Palästina zu bewerten, basieren auf hochaggregierten Datenbanken, die keine detaillierte Analyse der multiplen Implikationen simulierter Politiken liefern können.

Diese Arbeit hat fünf Forschungsziele: 1) Entwicklung einer detaillierten Datenbank für die Simulationsmodellierung und zur gesamtwirtschaftliche Analyse der Politik in Palästina, insbesondere im Westjordanland ; 2) Ermittlung der Modellspezifikationen, die die Besonderheiten des Arbeitsmarktes im Westjordanland erfassen und die Implikationen für die Simulationsergebnisse quantifizieren können; 3) Analyse der kurzfristigen Auswirkungen von Veränderungen der palästinensischen Beschäftigung in Israel; 4) Analyse der langfristigen Auswirkungen der steigenden palästinensischen Beschäftigung in Israel; und 5) Untersuchung der Auswirkungen von Änderungen des Handelsregimes auf die palästinensische Wirtschaft.

Da, das Westjordanland seit der Gaza-Blockade im Jahr 2007 das einzige palästinensische Gebiet ist, welches eine offizielle Handelsbeziehung zu Israel unterhält und auch nur Arbeitnehmer aus diesem Gebiet im israelischen Arbeitsmarkt beschäftigt sind, fokussieren sich die entwickelte Datenbank, sowie die Simulationen ausschließlich auf die Ökonomie des Westjordanlands. Aufgrund ihrer Fähigkeit die gesamtwirtschaftlichen Auswirkungen von Politikänderungen zu erfassen, werden für die Simulationen in dieser Arbeit allgemeine Gleichgewichtsmodelle verwendet. Ausgehend von einem standard Gleichgewichtsmodell wurden spezifische Erweiterungen entwickelt, um die Besonderheiten der Arbeitsmärkte und Handelsbeziehungen im Westjordanland sowie Haushaltspräferenzen zu modellieren.

Jedes der fünf Forschungsziele wird in einem separaten Kapitel der Arbeit behandelt. Die Hauptergebnisse in Bezug auf die Forschungsziele sind:

Die Datenbank: eine Social Accounting Matrix für das Westjordanland

Die Die Datenbank, die in der vorliegenden Arbeit entwickelt wird ist die erste detaillierte Social Accounting Matrix (SAM), die für das Westjordanland erstellt wurde. Sie hat mehrere besondere Eigenschaften. Sie ist ausreichend disaggregiert, um es zukünftigen Nutzern zu ermöglichen, je nach Fragestellung alternative Aggregationen zu wählen. Sie bietet eine detaillierte Darstellung von Gütern, Wirtschaftsaktivitäten, Arbeitsmärkten, Handelspartnern und Haushaltsgruppen, um die Auswirkungen von politischen Veränderungen der Mobilität von Arbeit, Gütern und Dienstleistungen auf die Wirtschaft des Westjordanlands sowie damit einhergehende Verteilungseffekte auf Haushaltsebene zu quantifizieren. Die entwickelte SAM berücksichtigt außerdem die Entlohnung der Arbeit von Selbständigen angemessen. Im Gegensatz zu den meisten schon existierenden SAMs berücksichtigt diese Datenbank darüber hinhaus, dass Haushalte Einkommen aus Kapital ohne eigene Rechtsperson erzielen. Die SAM basiert auf den zuverlässigsten und aktuellsten Daten zur Ökonomie des Westjordanlands. Das Basisjahr ist aus Gründen der Datenverfügbarkeit 2011. Das Jahr 2011 kann zudem als ein Jahr der relativen Stabilität betrachtet werden und ist somit als Basisjahr für Simulationsmodelle geeignet.

Identifikation und Auswirkungen verschiedener Faktorenmarktbedingungen

Vier stilisierte Modellspezifikationen werden häufig verwendet, um die Arbeitsmarktbedingungen in allgemeinen Gleichgewichtsmodellen darzustellen. Diese sind: gleichbleibendes Arbeitsangebot (Vollbeschäftigung), Arbeitskräfteüberschuss, ansteigende Arbeitsangebotskurve und Arbeit-Freizeit-Zielkonflikt. Von den vier Spezifikationen ist die ansteigende Arbeitsangebotskurve nicht wohlfahrtsneutral, da sie außerhalb der Produktionsgrenze des Systems der Volkswirtschaftlichen Gesamtrechnung (SVG) erzeugt wird, da Arbeitskräfte zu einem positiven Preis die SVG-Grenze überschreiten, jedoch keine Opportunitätskosten außerhalb der SVG berücksichtigt werden. Die Spezifikation des gleichbleibenden Arbeitsangebots, die neutral bezüglich außerhalb der SVG-Grenze erzeugter Wohlfahrt ist, setzt eine strikte Trennung zwischen Arbeit innerhalb und außerhalb der Grenze voraus. Aus diesem Grund werden Haushalte bei ihren Entscheidungen bezüglich der Allokation ihrer Arbeitskraft als gleichgültig gegenüber Änderungen der Lohnsätze betrachtet. Das Arbeitsangebot innerhalb der SVG-Grenze ist vollkommen unelastisch. Diese Spezifikation passt nicht zur Analyse der Auswirkungen der palästinensischen Beschäftigung in Israel, die eine Übertragung von Arbeitskraft über die SVG-Grenze hinweg beinhaltet, wie in mehreren empirischen Studien gezeigt wurde.

Unter den Bedingungen der beiden verbleibenden Spezifikationen stellt sich heraus, dass die Annahme eines Arbeitskräfteüberschusses ein geeigneter Rahmen ist, um die Arbeitsmarktbedingungen im Westjordanland kurzfristig abzubilden. Während diese Spezifikation die Effekte auf Beschäftigung, gesamte Endnachfrage und Wohlfahrt wahrscheinlich überzeichnet, erfasst sie gut die empirisch bewiesene unfreiwillige Arbeitslosigkeit im Westjordanland seit dem Ausbruch des Konflikts. Diese unfreiwillige Arbeitslosigkeit wird durch die Volatilität der palästinensischen Beschäftigung in Israel und die Unfähigkeit der relativ kleinen Ökonomie des Westjordanlands verursacht, kurzfristig eine große Anzahl von Arbeitern aufzunehmen.

Für eine langfristige Analyse ist der Arbeit-Freizeit-Zielkonflikt die bevorzugte Spezifikation, da sie explizit die Wohlfahrtsänderungen innerhalb und außerhalb der SVG-

Grenze berücksichtigt. Darüber hinaus wird langfristig davon ausgegangen, dass Arbeitsmärkte flexibel sind und dass Arbeitskräfte innerhalb oder außerhalb der SVG-Grenze beschäftigt werden könen. Daher wird auf lange Sicht keine unfreiwillige Arbeitslosigkeit angenommen. Dennoch erlaubt die Arbeit-Freizeit-Zielkonflikt die Übertragung von Arbeitskraft zwischen den Markt- und Nicht-Markt-Produktionssektors, was bei Änderungen der palästinensischen Beschäftigung in Israel erwartet wird.

Nach diesen Schlussfolgerungen wurde eine gründliche Bewertung der Auswirkungen der Veränderungen des palästinensischen Beschäftigungsniveaus in Israel sowohl auf kurze als auch auf lange Sicht durchgeführt.

Kurz- und langfristige Analysen der Auswirkungen von Veränderungen der palästinensischen Beschäftigung in Israel

Die Ergebnisse dieser Studie zeigen, dass eine Rückkehr der palästinensischen Beschäftigung in Israel auf das Niveau vor der *Intifada* unter der Annahme reduzierter Hemmnisse für die Mobilität von Arbeitnehmern zwischen dem Westjordanland und Israel kurzfristig positive Auswirkungen auf die Ökonomie des Westjordanlands hat. Eine steigende israelische Nachfrage nach palästinensischen Arbeitskräften absorbiert einen erheblichen Teil der Arbeitslosen und stimuliert sowohl Konsum als auch Produktion im Westjordanland. Arbeitslose treten in den Arbeitsmarkt ein, um nicht nur auf dem israelischen Markt, sondern auch auf dem heimischen Markt zu arbeiten. Dadurch sinkt die Arbeitslosenquote von 17,3% auf 10,9%. Letztendlich bewirkt dies Wachstum der Wirtschaft des Westjordanlands. Das reale BIP steigt um 3,6%. Die ökonomische Haushaltswohlfahrt verbessert sich im Durchschnitt um 5,5%.

Im Gegensatz dazu dominieren in der langfristigen Analyse die Effekte der "holländischen Krankheit" der zunehmenden palästinensischen Beschäftigung in Israel das Bild. Der zusätzliche Zustrom von Arbeitseinkommen aus Israel verringert die Anreize innerhalb der Produktionsgrenze zu arbeiten, da sich die Nachfrage Nicht-Markt Güter erhöht, was alle Dienstleistungen, die durch Aktivitäten außerhalb der Produktionsgrenze erbracht werden einschließt. Arbeitskraft wird von der Markt-Produktionsektors weg verlagert, und die reale Aufwertung des Wechselkurses verringert die Wettbewerbsfähigkeit der Exportwirtschaft des Westjordanland auf den Weltmärkten. Die Produktion im Westjordanland sinkt im Durchschnitt um 2,1%. Im verarbeitenden Gewerbe, dem führenden Exportsektor im Westjordanland, sinkt die Produktion dabei am stärksten. Dieses Ergebnis unterstreicht den Kompromiss zwischen dem Export von mehr Arbeitskräften nach Israel und dem langfristigen Export von mehr Waren und Dienstleistungen in den Rest der Welt. Letztendlich schrumpft die Ökonomie des Westjordanlands, da das reale BIP um 1,1% sinkt. Trotz des negativen Wirtschaftswachstums verzeichnen die privaten Haushalte einen

Wohlfahrtsgewinn von durchschnittlich 1,8%, da die gestiegenen Arbeitseinkommen aus Israel es ihnen ermöglichen, mehr Güter und Dienstleistungen zu konsumieren.

Im Vergleich der kurz- und langfristigen Analyse zeigt diese Arbeit, dass eine Steigerung der palästinensischen Beschäftigung in Israel die Wohlfahrt der Haushalte in beiden Fällen verbessert. Während sie auf kurze Sicht sowohl den Konsum als auch die Produktion im Westjordanland stimuliert, verringert sie auf lange Sicht das Wirtschaftswachstum, da sie die inländischen Löhne erhöht und die Wettbewerbsfähigkeit der Exportwirtschaft des Westjordanlands auf den Weltmärkten verringert. Die politischen Entscheidungsträger im Westjordanland sollten daher versuchen, die Wohlfahrtsgewinne der palästinensischen Beschäftigung in Israel zu erhalten und gleichzeitig die negativen Auswirkungen auf die inländischen Produktionskapazitäten zu reduzieren.

Zukünftiges palästinensisches Handelsregime

Diese Studie zeigt, dass die komplette Abschaffung der Zölle auf Importe aller Handelspartner alle anderen untersuchten Handelsregime übertrifft. Die Liberalisierung des Handels des Westjordanlands verbessert alle makroökonomischen Indikatoren im Vergleich zum *status quo,* der fortgesetzten Zollunion mit Israel. Die Ergebnisse zeigen auch, dass Israel der dominierende Handelspartner für das Westjordanland bleiben wird. Die Einführung neuer Zölle auf Importe aus Israel schadet der Wirtschaft des Westjordanlands und führt zu einem Ergebnis, dass aus ökonomischer Sicht nachteilig gegenüber einer fortgesetzte Zollunion mit Israel ist. Ein präferentielles Handelsabkommen mit Israel unter der Annahme moderater Zölle auf Importe und Exporte von und nach Israel, ist zwar schlechter als der gegenwärtige *status quo*, allerdings wünschenswerter als Handel mit Israel nach dem Meistbegünsstigungsprinzip. Obwohl eine stärkere Integration Palästinas mit den anderen arabischen Ländern wichtig ist, kann sie die wirtschaftlichen Beziehungen zu Israel nicht ersetzen, da Israel sowohl aus wirtschaftlichen als auch aus geographischen Gründen der natürliche Absatzmarkt für palästinensischen Handel bleiben wird.

Die Studienergebnisse zeigen auch, dass die Abschaffung der Kontingentzölle kaum Auswirkungen auf die Einfuhr von Agrarprodukten- und Lebensmitteln hat, da die Einfuhrquoten verbindlich werden und der heimische Agrar- und Ernährungssektor gegen Importkonkurrenz abgeschirmt ist. Eine Verdoppelung der Einfuhrquoten verbessert die Wohlfahrt der Konsumenten, verringert jedoch die Wohlfahrt der Produzenten im Westjordanland. Der Nettoeffekt ist ein Wohlfahrtsgewinn. Dieses Ergebnis hebt den Zielkonflikt zwischen Ernährungssouveränität und Verbesserung der Nettowohlfahrt hervor. Schließlich zeigt die Studie, dass die Geldpolitik einen wesentlichen Einfluss auf das Ausmaß der handelspolitischen Effekte hat.

Politische Implikationen

Diese Arbeit ermittelt die administrativen und politischen Optionen der PA zur Regulierung der Arbeitsmärkte und zur Gestaltung eines optimalen Handelsregimes.

Aufgrund der begrenzten Entwicklungsmöglichkeiten im Westjordanland, ist es für die PA in Bezug auf die Arbeitsmärkte interessant eine verstärkte palästinensische Beschäftigung in Israel anzustreben, um die Wohlfahrt der palästinensischen Haushalte zu verbessern. Die negativen Auswirkungen auf die Binnenkonjunktur sollten jedoch langfristig abgemildert werden. Um dies zu tun, könnte die PA die palästinensische Beschäftigung in Israel besteuern. Die sich ergebenden Steuereinnahmen würden dringend benötigte zusätzliche Einnahmen für die PA generieren. Mit diesen Einnahmen könnten Anreize für inländische Arbeitgeber geschaffen werden, in die Modernisierung von Produktionstechnologien zu investieren, um ihre Wettbewerbsfähigkeit auf den Weltmärkten zu verbessern. Die Steuer würde auch die Attraktivität der Beschäftigung in Israel verringern, einige Arbeitnehmer auf dem Binnenmarkt belassen und die strukturelle Abhängigkeit vom israelischen Arbeitsmarkt vermindern. Die etwaige Reduktion an palästinensischer Beschäftigung in Israel nach der Einführung der Steuer könnte jedoch durch den Aufbau von Beschäftigungsmöglichkeiten im Westjordanland durch die Anreize für den privaten Sektor ausgeglichen werden.

In Bezug auf das optimale Handelsregime zeigt diese Studie, dass das Westjordanland eine liberale, nicht diskriminierende Handelspolitik verfolgen sollte. Die Ergebnisse zeigen auch, dass Israel wohl der dominierende Handelspartner für das Westjordanland bleiben wird. Daher sollte die PA der freiest mögliche Mobilität von Gütern und Dienstleistung zwischen dem Westjordanland und Israel anstreben. Die Studie zeigt außerdem, dass die gewählte Geldpolitik starke Implikationen hat. Daher sollte die PA in der Zukunft die volle Kontrolle über ihre nationale Währung und deren Wechselkurs anstreben. Schließlich schützt das System der Zollkontingente für Agrarerzeugnisse und Lebensmittel wirksam die inländischen Produzenten vor dem Importwettbewerb, jedoch auf Kosten der Verbraucherwohlfahrt. Daher ist die Beibehaltung des Systems oder die Änderung der Importquoten eine politische Entscheidung bei der die Erreichung eines gewissen Maßes an Ernährungssouveränität gegen die Vorteile des Handels abgewogen werden muss.

1

GENERAL INTRODUCTION

Chapter 1 General introduction

1.1. Background

International trade, except smuggling, presumes a certain degree of inter-state cooperation (Heilmann, 2016). Trade relations in general, whether in goods or in services, and whether involving the movement of persons or not, require inter-state agreements. Both the General Agreement on Tariffs and Trade (GATT) and its successor the World Trade Organisation (WTO) have been a successful multilateral platform to foster inter-state cooperation and non-discriminatory trade (Mansfield and Reinhardt, 2003). Besides the trade liberalisation mechanisms enshrined in the WTO rules, the proliferation of preferential trade agreements (PTAs) since 1990 has contributed to the considerable reduction in the level of tariff protection around the world (Orefice, 2017). The PTAs aim at promoting trade with specific partners by providing a set of incentives. The signing of PTAs and the decision to join the WTO are all political decisions in the first place. Hence, trade flows do not only reflect a comparative advantage in production, but also political interests. Trade in strategic commodities particularly is initiated by countries to create dependency and influence the decisions of other countries (Goenner, 2010).

Despite the substantial reduction in tariff rates, the overall protection of domestic markets remains high on global average. The nature of barriers to trade has shifted from tariffs to non-tariff measures (Crivelli and Gröschl, 2016). Non-tariff measures include sanitary and phytosanitary measures and technical barriers to trade. These initially aim at protecting domestic resources and consumers from unhealthy or low-quality products. However, they effectively restrict trade. Especially for trade in services, barriers are not of the kind of explicit taxes, but rather regulatory obstacles (Dee *et al.*, 2014). Unlike goods, services are often intangible. Production and consumption decisions taking place simultaneously require the consumer or the producer to move before making an international transaction possible. Among the different modes of supply defined in the General Agreement on Trade in Services (GATS), the temporary movement of persons to supply services abroad is the most antagonistic (Stephenson and Hufbauer, 2010). Restrictions that impede trade in services often target the mobility of low or semi-skilled foreign workers. These restrictions often include quantitative regulations (quotas of workers), rules for obtaining work permits or business visas, and inefficiencies in the processing of such permits and visas (Cattaneo *et al.*, 2010).

When political conflicts arise, trade and labour mobility are affected in two ways. First, importers and exporters as well as workers and employers depend on continuity and stability to maintain long-term commercial and employment links. The expectation or outbreak of conflicts destroys those links and reduces the volume of trade and cross-border labour mobility (Long, 2008). Second, trade gives states a set of coercive instruments to signal their resolve in a political conflict. Through trade disruption measures, sanctions, and regulatory restrictions on the movement of persons, states aim at influencing the behaviour of the partner and making it change course. The outcome of the sanctions is a reduced trade volume between the partners (Heilmann, 2016) as well as a reduced flow of workers (Mansour, 2010). While both the sanctioning and sanctioned economies are negatively affected, the magnitude of the shock and the capacity of the economy to absorb it depend on the relative importance of trade for each partner. Small countries with few trading partners and a small number of traded commodities are particularly vulnerable to trade disruptions (Goenner, 2010).

Understanding the nexus of political decisions, trade, conflict and labour movement is the focus of this thesis. This issue has attracted scholarly attention mostly in the political economy arena. This thesis makes an empirical contribution to the field of international trade and labour economics by assessing the economy-wide effects of barriers to cross-border movement of goods, services and labour in conflict-affected regions with applications to the Palestinian-Israeli case. The thesis focuses on the economic impacts on the West Bank economy, using a computable general equilibrium (CGE) model. In the next Section, 1.2, the problem statement is clarified and the derived research objectives are presented in Section 1.3. Section 1.5 discusses the theoretical framework of the thesis. Then, the key outputs of the thesis are highlighted in Section 1.6; and finally, the outline of the thesis is presented in Section 1.7.

1.2. Problem statement

The Palestinian and Israeli economies have been partially integrated since 1967 (Missaglia and Valensisi, 2014). While an economic integration usually moves the different parties involved towards a convergence in terms of economic performance and living standards, the integration between Israel and Palestine is far from perfect. Until 1994, the integration was unilaterally decided by Israel and imposed on the Palestinian territories. Meanwhile, the Palestinian economy was held back by restrictions and regulations of different sorts (Botta, 2010). Moreover, the Palestinian production for the domestic market was undercut by the economies of scale realised by the technologically advanced Israeli manufacturers (Naqib, 2003). As a result, the Palestinian economy developed structural trade deficits and a high dependency on Israeli goods and labour markets (UNCTAD, 2016).

After the outbreak of the first Palestinian uprising in 1987, a protocol was signed between the Israeli government and the Palestinian Liberation Organisation in 1994 to regulate the economic relations between the two economies. Due to the asymmetry of power between the negotiating partners, on the one hand ,and to its transitional nature, on the other hand, the protocol failed to address the structural issues such as the creation of a Palestinian state with full ownership of economic policies and with unambiguous borders (Arnon, 2007). Instead, the protocol formalised the existing one-sided customs union, with the two economies co-existing within the Israeli-controlled borders (Arnon and Weinblatt, 2001). Trade policies in Palestine had to be aligned to the Israeli policies (Vaggi and Baroud, 2005). Consequently, the structural dependency on Israel for both trade and employment opportunities developed further. Israel accounted in 2016 for 58% of Palestinian imports and 83% of their exports (PCBS, 2017a). Moreover, 12% of Palestinian workers were employed in Israel in 2016 and the income they earned there represented about 12% of the Palestinian gross national income (PCBS, 2017b; PCBS & PMA, 2017).

In addition to this structural dependency, the Palestinian economy is vulnerable to the security-related measures implemented by Israel. The political conflict led Israel to impose tight restrictions on the free movement of goods, services and people between the two regions. Since the mid 1990s, Israel has conducted a closure policy consisting of roadblocks, curfews, and checkpoints that effectively restrict movements between the two regions (Ihle and Rubin, 2013). Moreover, for Palestinians willing to work in Israel, a work permit system based on personal criteria and sectoral quotas was implemented (Etkes *et al.*, 2012). As a result of these policies, the number of Palestinians employed in Israel substantially declined, raising unemployment and poverty rates in the Palestinian territories (Flaig *et al.*, 2013a).

The conflict between Israel and Palestine attracts substantial attention in the media for its violence, historical background and political developments. However, the assessment of the economy-wide implications of policy options in the areas of trade and labour markets on the Palestinian economy is understudied. Most of the previous studies that address the question of Palestinian trade options are either descriptive (Arnon and Bamya, 2007, Vaggi and Baroud, 2005, Fischer *et al.*, 2001) or use methods that miss the economy-wide effects of these policies (Schiff, 2002). Other studies (Astrup and Dessus, 2001 & 2005; Missaglia and Valensisi, 2014) are based on highly aggregated databases unable to provide a detailed analysis of the multiple implications of the simulated trade options. Similarly, most of previous studies that tackled policy change in the movement of labour between Palestine and Israel either miss the economy-wide implications (Etkes, 2012; Bulmer, 2003) or address the question from the perspective of the Israeli economy (Flaig *et al.*, 2013a), thus missing important implications for the Palestinian economy.

1.3. Research objectives

The main goal of this thesis is to explore the economy-wide implications of changes in barriers to the movement of goods, services and labour in conflict-affected regions. The thesis uses the case of the Palestinian-Israeli conflict and assesses the effects on the West Bank economy upon changes in barriers to the movement of goods, services, and labour between the West Bank and Israel. This main goal entails five research objectives:

1. Develop a detailed database to use in simulation models for assessing the economy-wide effects of policies in the West Bank
2. Identify the model specifications that capture the labour market conditions in the West Bank and quantify their implications for the simulation results
3. Analyse the short-term effects of changes in the employment of Palestinians in Israel on the West Bank economy
4. Assess the long-term effects of increased employment of Palestinians in Israel on the West Bank economy
5. Investigate the effects of changes in the trade regime on the West Bank economy

To achieve these research objectives a CGE model is used because this class of models is well suited to assess the effects of policy changes on the performance and structure of the whole economy (Arndt *et al.*, 2012).

1.4. Contributions to science

This thesis makes four contributions to science.

The first original contribution is the development of the first social accounting matrix for the West Bank which is currently the only Palestinian territory with trade and labour market relations with Israel.

Second, this thesis contributes to the current state of knowledge by assessing empirically the implications of different labour market conditions in CGE models.

Third, this thesis contributes to model development by adopting a nested utility function combining the benefits of linear expenditure systems and constant elasticity of substitution functions to depict household preferences. Moreover, this thesis extends the trade and production modules of the model to replicate the conditions in the West Bank economy.

Finally, this thesis contributes to policymaking by formulating political and administrative options for the Palestinian National Authority to achieve economic growth under suboptimal conditions due to conflict.

1.5. Theoretical framework

The theoretical framework of this thesis is based on the theory of economic interdependence and conflict and the computable general equilibrium modelling.

1.5.1. Theory of economic interdependence and conflict

The relationship between economic interdependence and conflict has been subject to a heated debate in the field of political economy. There are two distinct schools of thought in the debate. The first group, considered as the liberals, maintains that economic interdependence brings peace. The second group, considered as the realists, argues that trade increases conflict between the trading partners.

The liberal proposition is associated with Kant's philosophy of a perpetual peace that is the result of economic interdependence, expansion of democratic institutions, and joint commitment to the international law and institutions (Oneal and Russett, 2015). The liberals advance the theoretical argument that mutual dependence established between two trading partners (dyads) generates economic benefits for both parties, and that the anticipation of a loss in the welfare gains reduces the willingness of both sides to fight (Hegre *et al.*, 2010). Implicitly, liberals assume that the opportunity costs of the forgone trade are sufficiently high to prevent nations to engage in conflict with trading partners (Polachek and Xiang, 2010). They also infer that trade relations provide both parties with instruments to make costly signals in order to avert militarised conflicts (Heilmann, 2016).

The realist argument postulates that economic interdependence can be used as an instrument of coercion (Stein, 2003). Accordingly, the trading relationship entails costs that may result in conflicts. The costs are especially disproportionate for the more dependent partner, since the less dependent partner may be tempted to use economic coercion to exploit the other party's vulnerabilities and hence influence its behaviour on economic and security issues (Barbieri and Levy, 1999). Dependency on trade partners for the provision of strategic goods may trigger aggressive expansionist policies to guarantee access to resources and markets, increasing the likelihood of conflicts (Reuveny, 2000). The pursuit of relative gains, i.e. benefitting more from trade than a partner, also causes frictions between countries and leads to trade disputes and trade wars (Souva and Prins, 2006).

From this discussion it appears that there is no general conclusion on the effect trade has on conflict (Dorussen, 2006). Trade has both a pacifying and generating effect on conflict. At least three factors determine the direction of the trade effect on conflict. The first factor is whether the trade relation is symmetrical or not. Symmetrical ties may promote peace, while asymmetrical dependence fuels conflicts (Barbieri and Schneider, 1999). The second factor is the distance between the two partners. As demonstrated by Chang *et al.* (2004), the more the geographical distance between trading partners, the less the likelihood of conflicts. The third factor is related to the cost of finding alternative markets (Goenner, 2010). If finding alternative markets does not come at a high cost for importers and exporters, then the deterrent effect of trade on conflict is small. In contrast, if trade between a pair of partners is highly specific, the deterrent effect of trade on conflict is reinforced.

Another proposition to analyse the relations between trade and conflict is to separate conflict initiation from conflict escalation. Morrow (1999) showed that the trade effect on conflict initiation is mixed because trade relationships generate both gains and issues for debate. However, trade reduces the likelihood for conflict escalation, as it provides the actors with instruments to make costly signals and ultimately reach a peaceful settlement.

For their most part, the above-mentioned arguments have focused on the impact of trade on conflict. However, there are concerns that unidirectional models of trade-conflict relationships are miss-specified because trade is not an exogenous variable (Stein, 2003). In fact, the intensity of trade reflects a certain level of inter-state cooperation, as intergovernmental agreements are a pre-requisite for official trade. Moreover, trade can be restricted between partners as part of a strategic signalling (Gartzke *et al.*, 2001). This intertwined link between trade and conflict has led scholars to apply the Granger causality analysis and simultaneous equation systems to disentangle the trade effect on conflict and the conflict effect on trade. However, the results of empirical studies that make both trade and conflict endogenous diverge. Some studies found a statistically significant pacifying effect of trade (e.g. Oneal, 2003; Hegre *et al.*, 2010), while others found either no effect or a conflict-generating effect of trade (Kim and Rousseau, 2005). Other studies reported either a statistically insignificant effect of trade on conflict (Keshk *et al.*, 2004) or mixed effects (Goenner, 2010; Reuveny and Kang, 1998).

The diverging empirical results, though using in some cases the same data sources, is possibly explained by the omission of different fundamental elements of the overall trade and conflict picture (Reuveny, 2000). The validity of the theoretical assumptions that guide the empirical research is also at stake. Subsequently, there is a need for analyses at a more disaggregated level to incorporate differences in terms of commodity group, as well as isolating import and export data, instead of pooling the two into total trade (Dorussen, 2006). Studies should also look at individual dyads instead of pooling all dyads together because the relationship between trade and conflict is dyad-dependent.

Most of the discussions on trade and conflict have also embedded the unitary-actor view of the state (Stein, 2003). However, it is clear that trade is carried out by firms and reflects the societal supply and demand conditions, while conflict is an inter-state phenomenon. Therefore, it is important to disjoint the units of analysis. Finally the economic relations between states are not limited to trade in goods and services as pointed out by Souva and Prins (2006) and Gartzke *et al.* (2001). The bilateral flow of capital and labour should be incorporated in the analysis.

While the empirical results on trade effect on conflict are still puzzling, there is a wide consensus that conflict reduces trade (Heilmann, 2016; Long, 2008; Kim and Rousseau, 2005; Keshk *et al.*, 2004). Although liberal and realist theories disagree about the effect of trade on conflict, they appear to agree that conflict has a negative effect on trade (Reuveny, 2000). Along with this consensus, this thesis investigates the economic consequences of political conflict. The thesis makes an empirical contribution to the understanding of the relations between economic interdependence and conflict using a single dyad composed of Israel and Palestine. The thesis does not limit itself to the relations between conflict and trade of goods and services. Instead, it assesses the economy-wide effects of changes in the conflict-related restrictions on labour movements and trade of goods and services on the Palestinian economy. It makes use of a highly disaggregated database, in which firms and households, who make production and consumption decisions are explicitly separated from the government. The framework to conduct the empirical analysis is the computable general equilibrium (CGE) model.

1.5.2. Computable general equilibrium modelling

The concept of economic equilibrium at the heart of the CGE model refers to a state of balance between opposed forces acting upon the economic variables (Miller and Blair, 2009). Following the neoclassical theory of supply and demand, prices are assumed to clear all markets simultaneously. The economic agents are assumed to be rational. Households maximise their utility subject to a budget constraint, while firms maximise their profits subject to specific production costs and limited resources (Bacchetta *et al.*, 2012). The CGE model recognises that events taking place in one sector of the economy may affect other sectors, which could feedback into the original market through the price mechanisms. When the economy is affected by an exogenous shock, a new set of prices is obtained, which in turn determines production, consumption, employment and income levels.

The CGE model makes use of elaborated behavioural and technical relationships between the variables to capture all relevant linkages between the different sectors of the economy. The principle of accounting identities that underpins CGE models ensures that expenditures do not exceed incomes. Subsequently, the CGE model gets rid of "free lunches". These features of the CGE model make it well suitable for the assessment of a policy change on the performance and structure of the whole economy (Arndt *et al.*, 2012). Moreover, the way equilibrium prices are set relies on the economic theory, which makes the CGE model appealing for welfare analysis. Two theorems of welfare economics provide the background for capturing welfare effects in the CGE model (Cardenete *et al.*, 2017). The first is that any Walrasian allocation is a Pareto efficient allocation.

The Walrasian equilibrium implies that prices drive the allocation of resources and clear all markets. The Walrasian equilibrium corresponds to an allocation that lies on the contract curve, representing a subset of Pareto efficient allocations, where all the agents do at least as well as in their initial endowments. The second theorem is that a Pareto efficient allocation can be implemented as a Walrasian allocation with the use of lump-sum transfers from the winners to the losers. Following the second theorem, considerations of equity and efficiency can be separated, since the same efficiency level can be achieved with different allocations. The welfare measures that are widely used in a CGE model are the Hicksian compensating and equivalent variations. Using these measures is attractive since they are expressed in monetary units, making them intuitively comprehensible (Bacchetta *et al.*, 2012). Hence, they can be used for interpersonal comparisons of welfare.

1.6. Outputs of the thesis

This thesis has five outputs. The first is the Social Accounting Matrix (SAM) developed for the West Bank. The others are four applications, in which additions to the Static Applied General Equilibrium model, version 2 (STAGE-2), are conducted. These applications demonstrate the potential of the database and the model developments for carrying out empirical policy analysis. The SAM documentation has been published as a working paper, and earlier versions of the four applications have been published as conference papers[1].

The development of a comprehensive SAM relates to the first research objective of this thesis. The newly constructed SAM addresses several shortcomings of the previously elaborated SAMs for Palestine. It is more disaggregated, especially with respect to factor markets, household accounts and Palestinian trade partners. It focuses on the West Bank economy to acknowledge the reality that trade and labour movements between Israel and Palestine are restricted to the West Bank since the Gaza blockade in 2007. In the SAM, the Palestinian workers in Israel are identified and the labour income they earn in Israel is

[1] The SAM documentation as well as the conference papers were published as multiple–author papers and their full references are provided in the corresponding chapters of this thesis. For all papers, I am the first author, who drafted all text and made the most significant contribution for data and model developments.

channelled to their households. Decomposing the trade partners, in order to single out Israel is also an important feature of the SAM that allows addressing policy related to trade in Palestine. The reference year of the SAM is 2011 because 2011 was a relatively "normal year" with a stable political situation between Israel and Palestine.

To calibrate the SAM and implement the four applications, the STAGE-2 model – developed by McDonald and Thierfelder (2013) – is used as a starting point. The first application addresses the second research objective of the thesis and investigates the implications of different labour market conditions that can be used to capture the distortions of labour markets in conflict-affected regions. This first application sets the platform for more detailed analysis to be conducted in the next two applications using specific market conditions to model labour movements between the West Bank and Israel.

The second application addresses the third research objective of the thesis and analyses the short-term effects of changes in the level of Palestinian employment in Israel. For this purpose, a surplus labour specification is used to model the labour market conditions in the West Bank. This assumption captures the evidence of involuntary unemployment of labour in the West Bank and the strong correlation between the level of Palestinian employment in Israel and unemployment in the West Bank in the short-term.

The third application, associated with the fourth research objective of the thesis, assesses the long-term effects of Palestinian employment in Israel. To this end, a factor mobility function is introduced to depict that, in the long-term, labour markets are flexible. Moreover, the surplus labour assumption is replaced by a labour-leisure trade-off. The labour-leisure trade-off presumes the absence of involuntary unemployment in the long-term as labour can always be either employed in the market activities within the production boundary or in the non-market activities that produce services for the household's own use. The labour-leisure trade-off explicitly accounts for changes in the welfare generated in those non-market activities that are often disregarded as they produce services that are not for sale in the markets.

The fourth application addresses the fifth research objective of the thesis and investigates policies related to the movement of goods and services. In this application, future trade options for a sovereign Palestinian state – primarily with respect to Israel and secondarily with respect to the rest of the world – are analysed. These policies all assume an exit from the current customs union. The first policy option assumes the introduction of the most-favoured-nation tariffs on imports from Israel, and the second simulates a liberalisation of the Palestinian trade with respect to all trade partners. This application also acknowledges the existence of tariff-rate-quotas on agricultural and food products in the West Bank which are modelled explicitly. The model is modified to treat imports and exports from large and small trade partners differently.

1.7. Outline of the thesis

The thesis is organised as follows:

Chapter 2 reviews the theory of social accounting. The evolution of the concept of economic interdependence between production sectors and institutions within the economy is discussed together with an elaboration on the different formats for presenting such economic interdependence; namely the Input-Output Table, the Supply and Use Table and the social accounting matrix. Since a distinct feature of the SAM over the other formats is its focus on households and their ownership of factors, a discussion of the arguments for and against different approaches for classifying household and factor accounts is provided. This chapter finally provides insight into the use of the SAM framework for policy analysis.

Chapter 3 draws on the theories of general equilibrium. A discussion of the alternative approaches to modelling factor markets is provided in this chapter. The structure of the STAGE-2 model is described. The questions of price definition and price normalization are elaborated, and model closures that are a critical component of CGE modelling are discussed. The use of CGE models to analyse policy issues is also explored.

Chapter 4 provides an overview of the West Bank economy in terms of its development over time, the structure of its labour market and its trade relationships with Israel and with the rest of the world. The evolution and operation of the multi-faceted restrictions implemented by Israel are also reviewed in that chapter.

Chapter 5 documents the unique SAM compiled for the West Bank for this thesis.

The subsequent Chapter 6, Chapter 7, Chapter 8 and Chapter 9 cover the four applications conducted in this thesis to demonstrate the potential of the database and the model in addressing real-world policy issues. For a detailed description of the technical aspects involved in the modifications that were introduced in the original STAGE-2 model for the different applications, a technical appendix (Appendix 1) is attached to the main part of the thesis.

The thesis concludes with Chapter 10, where a general discussion of the key findings and the contributions made by this thesis are presented. This chapter also stresses the policy implications of the thesis. The limitations of the research are highlighted in the chapter and an outlook on potential areas for future research is provided.

2

SOCIAL ACCOUNTING MATRIX: ORIGINS, THEORY AND APPLICATIONS

Chapter 2 Social accounting matrix: origins, theory and applications

2.1. Introduction

A social accounting matrix (SAM) is a comprehensive database which encompasses information about the economic and social structure of a country or a region at a given point of time (Thorbecke, 2000). It explicitly shows the interconnections between the structure of production in the economy and the distribution of factor income to households as well as the relationships between all institutions (households, enterprises, government, and trade partners) in the economy. In addition to providing a useful framework to display information and give a snapshot of an economy, a SAM is also used as a benchmark in economic modelling to assess the socioeconomic impact of different policies (Breisinger *et al.*, 2009). Since the development of the first SAM by Stone in 1962, the SAM has been used extensively for policy analysis (Round, 2003).

The SAM is a practical extension of the theory of economic interdependence, which considers the whole economy as a single system of observable relationships. The theory of economic interdependence goes back to the scholastic economic thought in the 1600s, with the early notion of productive interdependence between different producers in a system characterised by the division of labour (Kurz and Salvadori, 2000). It is important to look through the historical lenses to understand the SAM and its evolution over time. Hence, in Section 2.2, the origins of the SAM are discussed, and its structure is presented. The SAM, compared to its predecessors is centred on institutions and the circulation of income, especially between factors and households. Subsequently, Section 2.3 focuses on decomposing the household and factor accounts. The use of the SAM as a basis for policy modelling is introduced in Section 2.4. Section 2.5 shows some applications of the SAM multipliers. Finally, Section 2.6 concludes this chapter.

2.2. Origins and structure of the social accounting matrix (SAM)

2.2.1. Origins of the SAM

The theory of economic interdependence can be traced back to William Petty, who coined in 1662 a clear concept of the agricultural surplus as the difference between the corn output and input including the subsistence of labourers measured in terms of corn. The unit of exchange, which is corn, is directly observable and the magnitude of the output and the inputs, in terms of corn, are also observable. About a century later, Francois Quesnay put together in the 1750s the first coherent framework to display the interdependencies in the economy, called the *Tableau Economique*. The *Tableau Economique* is a "zigzag" table that displays the flows of resources between the agricultural and manufacturing sectors. Moreover, it shows the circulation of capital between property owners, cultivators and artisans, along with the process of consumption and production.

While the *Tableau Economique* shows the interconnections between different economic sectors in a coherent way, it considers the agricultural sector as the only productive sector. The manufacturing sector is assumed sterile, i.e. yielding an output worth no more than the agriculture input that goes into it (Miller and Blair, 2009). Achille-Nicolas Isnard challenged this point of view in 1781, by arguing that the surplus is made of both agricultural and manufacturing products. Isnard showed that the set of prices in the *Tableau Economique* is a special system of prices, whereby the entire surplus originates in the agricultural sector. Classical economists, such as Adam Smith, David Ricardo and Robert Torrens share Isnard's view that relative prices determine the surplus. Moreover, they argue that the distribution of income originates not only from land rent but also from wages and profits (Kurz *et al.*, 1995).

The *Tableau Economique* was however praised by Karl Marx, as it casts light on the reproduction function of capital. This concept implies that the capital given in return to labour-power, i.e. wages, is converted into consumption expenditures in order to reproduce the labour-power able to work for the owner of the capital (Baumol, 2000). Starting from a representation of the economy similar to the *Tableau Economique,* Marx developed his own theory of reproduction and determination of the rate of profit. However, his two-step procedure – known as the successivist approach – cannot be sustained because the prices cannot be determined before the rate of profit, while the rate of profit cannot be determined before the prices. Hence, both the rate of profit and prices have to be determined simultaneously. The simultaneous determination of prices and the rate of profit was ultimately solved by Ladislaus von Bortkiewicz in 1907, by assuming the real wage rate to be given and by fixing a standard value as numeraire (Miller and Blair, 2009). In 1928, Leontief extended the *Tableau Economique* framework and the work of von Bortkiewicz to provide a flexible tool to analyse complex policy issues (Baumol, 2000). The new framework, called the Input-Output Table, describes in a tabular form the transactions involved in the production and consumption within an economy.

The starting point in the input-output analysis is the aggregate production, which is broken down into activities. These activities are interdependent since each needs outputs of the others as inputs. The rows of the Input-Output Table display the distribution of output throughout the economy, while the columns show the composition of inputs required by each sector. In addition to the inter-industry transactions, there are additional columns for the final demand, reporting sales of output to consumption as finished products by households, the government and for the export market. There are also additional rows for value added, which include the demand for labour, capital and land by the respective sectors as well as the indirect taxes paid in the process of production. The basic square framework of the Input-Output Table has evolved over time to reflect the potential for a single sector to supply multiple products. The non-square matrix obtained is called commodity-by-industry Input-Output Table. The accounts are generally kept in monetary units.

The advantage of the input-output analysis lies in its mathematical structure, consisting of a set of linear equations. With this convenient framework, the input-output analysis has become widely used especially as a policy analysis tool, by governments that wish to assess the structure and performance of the economy. The data required to build the Input-Output Tables became part of a routine collection of national economic statistics. In order to make the data collected in different parts of the world consistent with each other, such that they could be used to put together a multi-country or a world input-output system, common conventions started to be adopted in the 1940s. Such conventions as well as standards in dealing with the data collection process are included in the System of National Accounts (SNA). The basic framework of the SNA was put forward by Sir Richard Stone in 1947 in the landmark report of the United Nations titled: Measurement of national income and the construction of social accounts. The full framework was produced by Stone and Associates in 1968 and is regularly updated (Miller and Blair, 2009).

The SNA adopts an accounting system of double entry bookkeeping in which not only the inter-industry transactions are recorded, but they are also reconciled with all relevant flows of income and wealth. The SNA recognises that development is not the mere growth of output, but it is about raising the living standards of people. Accordingly, to address policy issues, the central point should not be the commodities but the people (Pyatt and Round, 1985). The SNA provides a coherent framework for measuring the social value of the economic activity; in other words, the national welfare (Aronsson and Löfgren, 2010). The framework of the SNA provides the basis for many forms of economic decision and can handle more systematically extended versions of the Input-Output Table such as the commodity-by-industry extension. The SNA also explicitly accounts for all transfers and transactions with the rest of the world. The data in the SNA are organised in sheets, also known as T-accounts, for individual sectors and institutions. All sheets are consolidated in a national balance sheet. The consolidated balance sheet can also be represented in a matrix form. The resulting matrix for production-consumption transactions is called the “Use” matrix, while the one for industry production of commodities is called the “Make” matrix. The “Make” and “Use” matrices can be consolidated to display information about the inter-industry transactions. The obtained matrix is called the Supply and Use Table (SUT).

The conventions adopted in the SNA are largely consistent with the input-output framework. A notable difference is that the SNA system is closed, i.e. the value of total production equals that of total consumption. Inventories are essentially a residual value, clearing the market to ensure that the supply is equal to the demand. Similarly, savings are residuals that clear the foreign account and the accounts for households and the government. In general, total savings equal total investments. In the "Make" matrix, total output, including home production for home consumption, is valued at the prevailing producer price (Miller and Blair, 2009). The Social Accounting Matrix (SAM) is the framework formulated specifically to represent all components of the closed system of national accounts.

The SAM's distinctive features as compared to the input-output and SNA frameworks include its representation by a set of single entry accounts and the focus it places on the roles of labour, households, and the social institutions in the economy (Round, 2003). Hence, the SAM provides a complete accounting of the circular flow of income and expenditure in the economy, and can be used to analyse social and economic policies in a comprehensive way. It aims particularly at addressing issues such as employment, income distribution, and social welfare. The SAM is a square matrix in which each sector or institution in the economy is represented by an account with its own row and column. For individual accounts, incomings and outgoings must balance to reflect the accounting identities. It follows that the whole system is balanced (Thorbecke, 2000). Since a SAM aims at reflecting the state of the economy in equilibrium, it should correspond to this by an appropriate choice of the base year.

2.2.2. Structure of the SAM

The social accounting matrix aims at organising information about the economic and social structures of a country or a region at a specific point of time, usually a year. A common way of depicting all transfers and real transactions within an economy is to present them in a circular flow diagram, as illustrated in Figure 2-1. In this diagram, expenditures made by one account are incomes for other accounts, such that the system is closed.

In the production process, activities use goods and services as intermediate inputs in addition to factors (labour, capital, natural resources). The final output is sold in the commodity markets. The value retrieved from the sale is used to buy intermediate inputs from the commodity markets, and to compensate factors. The remaining output value is paid to production and factor use taxes. Net factor payments – i.e. factor returns received from the domestic activities reduced by the depreciation plus the factor compensation from abroad – constitute the factor income that accrues to the ultimate owners of factors which are households, enterprises and sometimes other institutions.

In addition to the factor income, households derive income from remittances, inter-household transfers, transfers of profits and dividends from enterprises, and transfers from the government and the non-profit institutions serving the households (NPISH). Household income is spent on goods and services, direct taxes to the government, and the rest is saved. Government's revenues are composed of indirect taxes on goods and services, and direct taxes on enterprises and households. Those revenues are spent on services and transfers, and the rest is saved. The NPISHs receive donations from abroad and from domestic households. Their budget is spent on goods and services as well as in the form of transfers to the households.

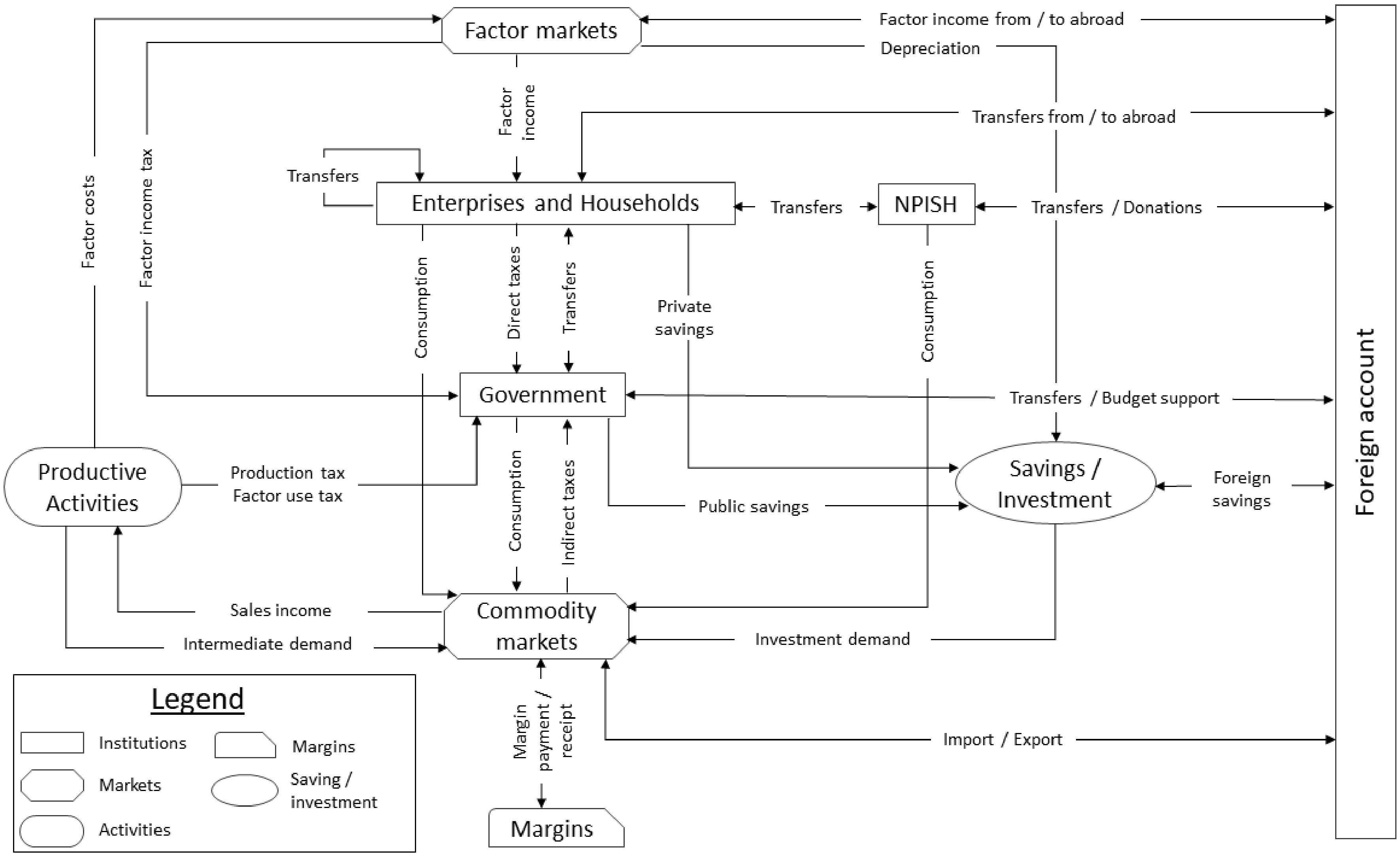
The interactions with the rest of the world are captured through the flow of imports and exports, transfers and factor payments. The rest of the world account is cleared by the foreign savings. In the domestic market, public and private savings are collected in the capital account which is then used to satisfy the investment demand.

Finally, margins represent the costs for transferring a commodity from the source of production to the place of final consumption. The margins are payments to trade and transport services from commodities. Hence, they are considered to be inter-commodity transactions.

A SAM is a numerical representation of the transactions depicted in the circular flow diagram. It presents the information in a matrix form, where economic sectors and institutions are represented each by one account. Each account is depicted by a row and a column. The income to each account appears along the account's row, while the expenditure appears along its column. Hence, a cell entry in the matrix represents a particular transaction within the economy flowing from the column account to the row account. The accounting principle requires that for each SAM account, the income equates the expenditure (Croes and Rivera, 2016).

Compiling a SAM requires a substantial effort. The number of accounts and the level of detail to include in a SAM often depend on the available data and on the problem under investigation (Pyatt and Round, 1985). Table 2.1 displays the standard structure of a SAM as a 15x15 matrix, with a distinction between the domestic economy and the rest of the world. Hence, it is assumed that the domestic economy is not closed. The SAM adopts a commodity by industry set up. The production factors are disaggregated into labour, capital and land. There are provisions for four domestic institutions: households, enterprises, government and the NPISHs. The tax instruments are separated from the government account and finally there is a saving-investment account.

Figure 2-1. Circular flow diagram



Source: Own illustration

Table 2.1. SAM structure

			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
							Factors			Institutions				Taxes			
			Commodity	Margins	Activities	Labour	Capital	Land	Households	NPISH	Enterprise	Government	Direct	Indirect	Investment	Foreign account	Total
1		Commodity		Margins	Intermediate inputs				Private consumption	NPISH consumption		Government consumption			Investment demand	Exports	Total demand
2		Margins	Margins														Margins
3		Activities	Market output														Activity income
4	Factors	Labour			Labour compensation											Compensation of employees from abroad	Labour income
5	Factors	Capital			Capital compensation											Capital income from abroad	Capital income
6	Factors	Land			Land compensation												
7	Institutions	Households				Labour income to households	Unincorpo-rated capital income	Income from Land rent	Inter-household transfers	NPISH transfers to households	Dividends	Government transfers to households				Transfers to households from abroad	Household income
8	Institutions	NPISH							Household transfers to NPISH							Transfers to NPISH from abroad	NPISH income
9	Institutions	Enterprise					Capital return to enterprise					Transfers to enterprises					Enterprise revenue
10	Institutions	Government									Investment profit		Direct tax revenue	Indirect tax revenue		Foreign grants	Government income
11	Taxes	Direct				Factor income tax			Income and property tax		Corporate tax						Direct tax revenue
12	Taxes	Indirect	Commodity taxes		Production and factor use taxes												Indirect tax revenue
13		Investment					Depreciation		Household savings		Enterprise savings	Government savings				Current account balance	Savings
14		Foreign account	Imports			Labour compensation to abroad	Capital payment to abroad		Household transfers to the abroad								Foreign exchange outflow
15		Total	Total supply	Total margins	Activity expenditures	Labour expenditures	Capital expenditures		Household expenditures	NPISH spending	Enterprise spending	Government expenditure s	Domesti c tax revenue	Collected tax revenue	Investment	Foreign exchange inflow	

Source: Own compilation

2.3. Decomposing household and factor accounts

The focus of the social accounting matrix is on the people and their living standards. The living standards are intimately related to the income households derive from factors they own. Therefore, a special care must be paid to disaggregating households and their factors of production. There are several classification schemes for disaggregating household and factor accounts. However, the main principle is that each group should be homogenous and distinct from the other groups. Given the interdependencies between households and production factors, decomposing the household account should be consistent with the disaggregation of factor markets.

An initial differentiation of production factors may refer to labour, natural resources, and capital markets. Each of these production factors can be further disaggregated. Labour is often classified by skill. The skill level is defined either by the number of years of formal education or by the professional occupation. The International Labour Organisation (ILO), in its classification ISO-08, distinguishes four levels of skill based on the educational level (ILO, 2012). The skill level 1 includes workers who completed primary education. In terms of occupations, this corresponds to manual and elementary jobs such as office cleaners, freight handlers, garden labourers, etc. The skill level 2 requires the completion of the first stage of secondary education and necessitates some technical abilities. Occupations associated with this skill level include butchers, bus drivers, secretaries, sales assistants, agricultural workers, etc.

Skill level 3 involves a high level of literacy, meaning the completion of the second stage of secondary school as well as attending a higher educational institution for a period of one to three years. Occupations classified at that skill level include shop managers, technicians, legal secretaries, etc. The last level of skill requires extended levels of literacy and numeracy. It corresponds to studying at a higher educational institution for a period of four to six years with the award of a degree. Occupations at this level include professional sales managers, engineers, teachers, medical practitioners, etc.

Labour can also be disaggregated based on employment status (employee, employer, own-account worker), location (urban/rural or geographical region), gender, or employment sector (agriculture, manufacturing, services). The main driver of the choice for a classification should always be the amount of information available and the motivation/purpose of the analysis.

Similarly, depending on the purpose of the research, capital can be disaggregated into public and private, or is assumed sector-specific. Natural resources can also be assumed sector-specific or region-specific. Land in particular can be classified into irrigated or non-irrigated land, crop versus pastureland, fertile or non-fertile land, etc.

In the SAM framework, households are the units making saving and spending decisions. Hence, disaggregating the household sector is desirable. Disaggregating households depends on the particular focus of the analysis, the available data and the classification of other accounts, notably the factor markets. There are many classifications that are applicable to the household account. The classification criteria include the location (urban versus rural), assets (size of land holding, properties), income level, and socioeconomic characteristics of household members (e.g. household head, principal earner and economically active members). A combination of these criteria is also possible. For instance, urban households can be further classified by income level, while rural households are further classified by the landholding size. Using the socioeconomic criteria ensures homogeneity of behaviour and of interest among groups, while classifying households based on their income level assumes homogeneity of income for distinct groups. Because households are potentially mobile across income groups, the socioeconomic criteria are often preferred for *ex-ante* analyses. However, classifying households along income groups fits better cross-sectional comparisons where the focus is to assess income distribution between classes of households (Round, 2003).

The choice of a classification is a defining moment in the SAM construction because the choice made has strong implications on the analyses. Therefore, it is desirable to maintain a high degree of flexibility in terms of detail available in the SAM in order to allow the user the possibility to aggregate the SAM and choose alternative classifications (Thorbecke, 2000). Providing a SAM with sufficient details and flexibility has been made possible in recent years by the powerful spreadsheet technology and the software capability. Nevertheless, the main obstacle to a highly disaggregated SAM is often data availability, especially as far as household and factor classifications are concerned. Disaggregating households requires a multi-purpose household survey that provides detailed information on income and expenditures. Similarly classifying factors, especially labour, is only feasible if there are raw data or detailed publications of labour force surveys.

Including the interdependencies between households and factor markets in the SAM in a consistent way requires the household income and expenditure survey to be consistent in the first place with the labour force survey. Even when the two surveys are available and consistent with one another, there are still challenges in reconciling the survey data with the national economic statistics. Discrepancies between statistics in the national accounts and the survey data can be large. To handle these discrepancies, one can rely either on local expert judgments, or on mathematical algorithms or a combination of both.

Informed judgement of the relative reliability of the different data sources and local expert insights are valuable but suffer the drawback of being subjective. By contrast, a formal mathematical algorithm is less subjective in estimating the SAM and can enforce consistency of the whole system. However, its drawback is that the estimated figures may deviate strongly from reality. Therefore, a combination of informed judgement and mathematical algorithm should be preferred (Round, 2003). Informed judgement will be used to improve the initial estimates and reconcile the data as much as possible. Then, the mathematical method can be applied to carry out the relatively small remaining adjustments and enforce consistency.

Another challenge is to disentangle the different sources of household income. A major concern is the demarcation line between labour and capital income. A conventional measure of labour income is the compensation of employees, which encompasses wages and salaries in addition to other forms of non-wage compensation (commissions, bonuses, pensions, family allowances, etc.). However, this measure underestimates the actual labour income as it omits the labour compensation of the self-employed (Gollin, 2002). Such bias is especially big in the developing countries, where there is a large informal sector. In such economies, small family businesses also called household activities play an important role. The self-employed are often engaged in such activities and the income they earn is often referred to as mixed income. The concept of mixed income is usually calculated as a residual and makes it difficult to evaluate the share of household income derived from capital or labour. The inability to evaluate the factor shares of income does not make understanding income distribution and inequality easy (Atkinson, 2009).

Different adjustment approaches have been suggested to address the issue. Guerriero (2012) compared five adjustment approaches to the initial unadjusted measure. The first adjustment approach is to impute two thirds of the mixed income to labour income, assuming that the capital share of mixed income is one third. The main problem with this approach is the arbitrary "two thirds" rule since the labour share of mixed income may be region-specific, or sector-specific and may also vary over time. Hence, this rule cannot be universal. A second adjustment approach is to attribute all the mixed income to labour. The rationale being that in developing countries, the self-employed mostly provide labour services. An obvious drawback of this method is that it overstates the labour income since most household activities also require capital investment that in some cases can be substantial. A third approach is to assume that mixed income has the same combination of labour and capital as the rest of the economy. This approach has the merit of accounting for capital and labour shares in mixed income using reasonable assumptions. However, the assumption that income distribution is approximately the same in unincorporated family businesses and in formal corporations is unrealistic as these are very different agents.

A fourth approach is based on the fact that the previous methods often estimate mixed income as a residual and may not be reliable. Subsequently, this approach only builds on the number of the self-employed, which is often available from labour force surveys and is more reliable than earnings reported from mixed income that are computed at the national level. Accordingly, the compensation of labour for the self-employed is imputed by assigning to them the average compensation of employees. The drawback of assuming the same earnings for wageworkers and the self-employed persists. Nevertheless, this approach is preferred to the previous ones because it considers the regional composition of the workforce. The fifth approach proposes an adjustment to the forth method. It proceeds from the international classification of status in employment (ICSE-93) which assumes that the self-employed can be associated with four worker categories: employers, own account workers, members of producer cooperatives, and family workers (ILO, 2013). This approach considers that the employers receive a negligible amount of labour income. Therefore, it attributes the average compensation of employees to all self-employed categories except employers. In this approach, neglecting the labour income received by employers may underestimate the total labour income.

The two last approaches are often preferred to the first three. However, both rely on the problematic assumption of identical average wages for the self-employed and wageworkers. To attenuate the problem associated with this assumption, Young (1995) attributed the wages of employees to the self-employed on the basis of sector of employment, gender, age, and education. Matching wageworkers and self-employed using socioeconomic characteristics reduces the systematic differences between the two categories, but the drawbacks are the high data requirements and the omission of unobservable differences in entrepreneurial ability. Gindling *et al.* (2016) addressed the problem from a different angle by estimating econometrically the earnings premiums for the self-employed across 73 countries. Subsequently, they extrapolated their results to different regions of the world. While this approach seems more accurate, the earnings premiums may change over time. Hence, the estimates need to be regularly updated. Moreover, the earnings premiums are estimated as averages at the national level, while they may differ across sectors.

In conclusion, decomposing household and factor accounts is an important step in the process of constructing a SAM, since the main addition of the SAM over the other accounting systems is the focus on institutions and the circulation of income. There are several options and criteria along which the household sector and the factor markets can be disaggregated. The main principle is to keep as much detail as possible for the framework to be flexible to address multiple analytical questions. In the process of disaggregating households and factors, several challenges arise. Some options to deal with such challenges have been discussed. In Chapter 5, the way these problems have been dealt with in the process of constructing the SAM for the West Bank is presented.

2.4. SAM as a theoretical framework

The SAM is not only a framework for an empirical description of an economy, but also a format to present the economic theory (Pyatt, 1988). By definition, the SAM displays in a comprehensive way the economic transactions within the economy. To illustrate the SAM as a theoretical framework, the transactions taking place are represented by algebraic expressions instead of numbers. Those algebraic expressions describe in conceptual terms how the value of each transaction is determined. Each transaction in the SAM has both quantity and price dimensions, as illustrated in Equation [2.1].

$$\boldsymbol{T_{ij} = p_{ij} * q_{ij}} \qquad [2.1]$$

Where T_{ij} is the SAM entry for row *i* and column *j*, while p_{ij} and q_{ij} are the price and the quantity associated with that transaction respectively.

Since a SAM is balanced by definition, total cost should equal total revenue to reflect the accounting identities. In other words, column totals should equal row totals, as illustrated in Equation [2.2].

$$\sum_i (p_{ij} * q_{ij}) = \sum_i T_{ij} = \sum_j T_{ij} = \sum_j (p_{ij} * q_{ij}) \qquad \forall i = j \qquad [2.2]$$

According to the "Law of One Price", identical goods sold in different markets should sell for the same price (Funke and Koske, 2008). Subsequently, the row totals can be rewritten as in Equation [2.3].

$$\boldsymbol{\sum_j T_{ij} = \sum_j (p_{ij} * q_{ij}) = p_i * Q_i \quad with\ Q_i = \sum_j q_{ij}} \qquad [2.3]$$

Where p_i is the price and Q_i the total demand for *i*. Replacing the new insight from Equation [2.3] in Equation [2.2], enables the rewriting of the column totals as follows:

$$\sum_i (p_{ij} * q_{ij}) = \sum_i T_{ij} = p_i * Q_i \qquad [2.4]$$

Where p_i now reads as the average cost.

It follows that in the SAM framework, price or average revenue (in the rows) equals average cost (in the columns). Therefore, prices and costs are interconnected and the price in each row is uniquely determined by the cost information contained in only one column. Commodity and activity prices depend not only on each other but also on factor prices, the exchange rate and income levels, as illustrated in Equation [2.5]:

$$p = p(y; p, f, \lambda) \qquad [2.5]$$

Where p is a vector of commodity prices, y is the income vector, f is a vector of factor prices and λ is the exchange rate (domestic per world unit).

The set of Equations [2.5] is called the supply-side equations because it corresponds to a summation along the column. Supply-side equations show how commodity prices are determined in a way that clears the markets. They are linear homogenous and consistent with the adding-up condition. The linear homogeneity condition implies that for a stable level of production if all input prices double, then output prices will also double. The adding up condition infers that income for any factor, for instance, is allocated in proportion to the ownership of that factor by the different institutions, so that total income is allocated in proportions that add up to 100 percent.

The specification of the supply-side equations allows for the specification of imports and domestic supply to be perfect substitutes, or complements and also to implement the Armington assumption of differentiated imports and domestic supply. Accordingly, policies targeting tariffs, taxes, quotas and other trade restrictions can be implemented. Finally, the equations allow the choice of the appropriate technology of production by solving a cost minimisation problem.

The row summation provides the demand-side equations, representing the total income of each account. Incomes are derived from both exogenous and endogenous sources, as illustrated in Equation [2.6]:

$$\boldsymbol{y} = \boldsymbol{n} + \boldsymbol{x} \qquad [2.6]$$

Where n and x refer to the sets of endogenous and exogenous income sources respectively. Endogenous income sources are related to transactions whose values depend on prices and are determined within the model. Exogenous sources are predetermined and taken as given. The choice of which elements of the SAM to consider as exogenous is discussed in more detail in the next section, Section 2.5. For any column containing one or more exogenous cells, a balancing residual cell needs to be specified in order to satisfy the adding up condition.

From Equation [2.5], it follows that there is a number of $y + p + f + \lambda$ variables, while from Equations [2.5] and [2.6] there are only $y + p$ equations. However, in equation [2.6], one row is linearly dependent on the remainder (Pyatt, 1988). Therefore, the actual number of equations becomes $y + p - 1$. Therefore, the system of equations contains $f + \lambda + 1$ degrees of freedom. To solve such a system of equations, a third set of $f + \lambda + 1$ equations is needed. These are called the closure rules. A wide range of choices is available and is most often concerned with the factor markets, investment and government accounts. The choice of closure rules within the framework of computable general equilibrium models is discussed in more detail in Section 3.6 of Chapter 3. Noteworthy here is that at least one closure rule must not be linear homogenous. Subsequently, a particular price is set as the numeraire for the entire system.

To summarise, the SAM framework structures any theoretical specification into three parts: the demand-side equations, the supply-side equations and the closure rules. This theoretical framework of the SAM lays the ground for the specification of a model to capture the behaviour of each cell of the SAM. The model of behaviour provides the tool for subsequent applications and policy analyses.

2.5. Application of the social accounting matrix: SAM multiplier analysis

A major use of the information contained in a SAM is to assess the effect of an exogenous shock on the structure and performance of the economy. The simplest specification of SAM-based models is the SAM multiplier models, which assume both factor prices and exchange rates to be fixed. The application of such models generally addresses descriptive and predictive questions. The descriptive analysis aims at examining the interactions within the economy, while the predictive analysis addresses changes resulting from exogenous shocks.

The SAM multiplier analysis rests upon a set of linear equations, with the numerical magnitude of the coefficients of these equations reflecting the structural interdependence among different sectors in the SAM. The coefficients are fixed and their ratio is constant. Subsequently, the production system is assumed to reflect constant returns to scale. In other words, whatever the change in the output, the relative composition of inputs is always the same. By freezing the production structure, this class of models usually provides a starting point for a policy debate with useful insights into the anatomy of the economy.

There are two types of multipliers: the simple and the total multipliers. The simple multipliers capture the direct and indirect effects of an exogenous change, while the total multipliers include the induced effects in addition to the direct and indirect effects (Miller and Blair, 2009). Direct effects relate to changes in the sectors directly connected to the exogenous shock. For instance, change in the output after the shock. Indirect effects record how the effects are transmitted to households. Induced effects are associated with the feedback effects associated with changes in factor income due to changes in factor demand by the production sectors. By ignoring the induced effects, the simple multipliers – also called open models – assume the final demand to remain constant.

In order to account for the induced effects, a decision is needed on which of the components of the final demand to treat endogenously in the model. Often, households are included as an endogenous sector, because household consumption is the single largest component of the final demand with a share of about 60% (Round, 2003). A model that treats households endogenously is considered closed with respect to households. By including the induced effects, closed models generally tend to yield outcomes larger in magnitude than the open models. While the closed models may be more useful to assess the wide impact of exogenous shocks, the open models may be more attractive if the focus is on identifying and ranking the sectors that are the most affected by a shock (Miller and Blair, 2009).

Closing models is associated with some challenges. First is the problem of fixed coefficients. In a model that is closed with respect to households, the commodity shares of household consumption and the distribution of factor income to households are fixed. Subsequently, a drawback of the approach is to freeze the household behaviour, with household consumption and income patterns remaining the same. Second, the model being static means that it reflects a database that displays information on the economy in a given period. Hence, the coefficients that are derived from the database can be seen as the average behaviour during the observation period. However, these coefficients are assumed to hold for the marginal changes occurring as the result of an exogenous shock. As an illustration, the initial household consumption pattern is assumed to hold for the additional earnings generated by new outputs. Such an assumption ignores cases where both established residents and new residents (in-migrants) generate the new output. While for the new migrants, the average initial consumption pattern might hold, for the established residents, the spending of the new income along a marginal consumption pattern might be more suitable. As the marginal spending pattern of a household depends on its income category, it might be interesting to disaggregate households according to income groups.

Given the challenges associated with closing models, only one component of the final demand, i.e. household, is usually made endogenous (Miller and Blair, 2009). For a thorough analysis, the interaction of price changes and shifts in exogenous demand – including variations in the exchange rates and in factor prices – should be embraced. These steps are at the core of the equilibrium models and will be discussed in Chapter 3.

2.6. Conclusion

The SAM is a convenient approach to organise data and show the interdependencies within an economy. It derives from a concept of economic interdependence in the production structure that has evolved over time to incorporate more detail about institutions and the circulation of income in the economy. Once the data are organised in the form of a SAM, they present a snapshot which reveals the economic structure of a region or a country at a given point of time. The SAM is not only a framework to show the interconnections within an economy, but it also has a theoretical background and a mathematical structure that enables the assessment of the reaction of that economy to exogenous shocks. Based on a set of linear equations that underlines the mathematical structure of the SAM, the multiplier analysis provides a useful starting point to discuss the impact of policies, including the welfare effects.

A major criticism of the SAM multiplier analysis is the temporal stability problem. The technical coefficients used in the analysis are fixed and they reflect the state of the economy in an earlier year. However, it is clear that the production structure and the consumption patterns will change for a variety of reasons including technological progress, changes in economies of scale, changes in relative prices, and changes in consumer preferences. Although these changes are usually slow, ignoring them reduces the accuracy of the analysis. Nevertheless, as argued by Miller and Blair (2009), from the perspective of the macroeconomic indicators, the error associated with the use of "old" data for "new" times may not be large. For such aggregated measures which contain a wide variety of individual elements, substitution between those elements tends to stabilise those measures.

Another criticism of the SAM multiplier analysis is that it assumes prices to be constant, and therefore cannot capture how the economic agents react to price changes due to an external shock or a policy change. To deal with this issue, the SAM can serve as a benchmark for a model that displays the causal relationships among variables. Such a model enables the empirical assessment of the reaction of the economic agents to price changes by capturing explicitly the behaviour of those agents. Using a SAM to calibrate such a model provides a natural starting point for the search of a new solution when there is an exogenous shock to the base year configuration. This class of models includes computable general equilibrium models, which are the focus of the next chapter.

3

COMPUTABLE GENERAL EQUILIBRIUM MODELS: THEORY AND APPLICATIONS

Chapter 3 Computable general equilibrium models: theory and applications

3.1. Introduction

The Computable General Equilibrium (CGE) model recognises that changes taking place in one sector of the economy may affect other sectors, which could feedback into the original market. The CGE model makes use of elaborated behavioural and technical relationships between variables to capture all linkages between the different sectors of the economy. The links between the sectors in the economy are controlled by equations that ensure expenditure not to exceed income, and income to be determined by factor earnings. Similarly, the sum of factor amounts used in the production does not exceed the amount of factor endowments. Subsequently, a CGE model gets rid of "free lunches" by including budget constraints (Bacchetta *et al.*, 2012).

The CGE modelling is based on the Walrasian theory of general equilibrium. In Section 3.2, the theoretical framework of general equilibrium modelling is presented. Section 3.3 discusses in more detail how to model labour markets. Section 3.4 shows how the theoretical framework of general equilibrium can be applied to policy issues, especially by making use of social accounting matrices. Then, Section 0 displays the typology of CGE models, while Section 3.7 highlights the basic structure of a comparative static model, which is later extended in the applications conducted in the thesis. Finally, Section 3.7 concludes this chapter and elaborates on the limitations of CGE models.

3.2. Theory of CGE models

The concept of economic equilibrium is at the heart of the CGE model. An economic equilibrium refers to a state of balance between opposed forces acting upon economic variables (Miller and Blair, 2009). The concept was first introduced by Leon Walras. To describe Walras' law and the Walrasian equilibrium, we assume first a pure exchange economy, where all agents are given an initial endowment of commodities to trade. The agents are rational, meaning that they participate in trade as long as they are better off than not trading. This implies that they maximise their utility subject to a budget constraint. The agents' demand functions can be derived by solving this utility maximisation problem. The obtained demand functions are continuous and homogenous of degree zero in prices. This implies that doubling all prices and incomes will leave the quantity demanded the same.

To close the system, a condition that for each agent the value of total consumption equals the value of the agent's endowment is imposed. This condition implies that at the whole economy level, the value of market excess demand is zero at all prices (Equation [3.1]).

$$\sum_{i=1}^{N} p_i * \delta_i(p) = 0 \qquad [3.1]$$

Where p_i is the price of commodity *i*, $\delta_i(p)$ is the market excess demand, and N the number of commodities.

The equality in equation [3.1], also called the Walras' law, implies that if all markets but one are cleared, then the remaining market must also be cleared. This is a necessary condition for a market equilibrium, but it is not sufficient because it holds for all prices, whether they are equilibrium prices or not. For a set of prices to become equilibrium prices, the sufficient condition is that demand is no greater than supply at the equilibrium as in Equation [3.2]:

$$\delta_i(p^*) = \chi_i(p^*) - e_i \ \leq 0 \qquad \forall i \ and \ p^* > 0 \qquad [3.2]$$

Where p^* is the equilibrium price, $\chi_i(p^*)$ is the market demand at the equilibrium price, and e_i is the market supply.

Under this condition, prices drive the allocation of resources and clear the market. This is the general form of the Walrasian equilibrium. In case of strict equality, there is no excess demand. In case the supply is greater than the demand, there are "free goods" in the market, whose prices – following equation [2.6] – should be zero (Cardenete *et al.*, 2017).

Equation [3.1] implies that one out of the N equations is redundant. Hence, there are N variables with N-1 equations. To solve the system of equations, one price needs to be fixed as a numeraire. Then, the whole system solves for relative prices. The uniqueness of the Walrasian equilibrium is an important condition for comparative static analyses. For a pure exchange economy, a sufficient condition for the uniqueness of the equilibrium is that the aggregate excess demand functions satisfy the gross substitutability property, i.e. the elasticity of substitution in consumption for each agent is larger than one (Cardenete *et al.*, 2017).

Moving from the abstract exchange economy to a real economy with production possibilities, the agents' rationality assumption is extended to producers. Hence, consumers maximise their utility while producers maximise their profit. The equilibrium price clears the market and ensures that both households and firms achieve their objectives simultaneously. When the economy is affected by an exogenous shock or a policy change, a new set of prices is obtained, which in turn determines production, consumption, employment and incomes. In addition to the agents' rationality, prefect competition conditions are usually postulated for the working of the market. Perfect competition implies a large number of participants and no barriers to the circulation of information in the market. Hence, prices are known to all participants and they are all price takers, meaning that they cannot individually exert any influence over prices. When markets are perfectly competitive, there is the implicit assumption that the production technology is governed by constant returns to scale and that profits are driven to zero (Bacchetta *et al.*, 2012). A necessary and sufficient condition for optimality in perfectly competitive markets is that the ratio of prices equals the marginal rate of transformation. Subsequently, the way equilibrium prices are set relies on an efficient mechanism with implications for welfare analysis.

The inference of welfare effects from the CGE model is appealing because the material resources of any economy are there to satisfy human needs. Two theorems of welfare economics provide the background for capturing welfare effects in a CGE model. The first is that any Walrasian allocation is a Pareto efficient allocation. The second is that a Pareto efficient allocation can be implemented as a Walrasian allocation with the use of lump-sum transfers (Cardenete *et al.*, 2017). A Pareto efficient allocation is one where nobody can be made better off without making at least one individual worse off. As such, a Pareto efficiency only depends on total endowments and individual preferences. However, the Walrasian equilibrium depends on individual preferences, individual endowments and on prices. Therefore, not all Pareto efficient allocations can be a Walrasian equilibrium.

The first theorem implies that in the Walrasian equilibrium, all the agents reach a collective optimal welfare, such that departing from the equilibrium will generate more welfare losses than gains. Subsequently, the Walrasian equilibrium lies on the contract curve, representing a subset of the Pareto efficient allocations, where all the agents do at least as well as in their initial endowments. The second theorem implies that any Pareto efficient allocation can be made equivalent to the Walrasian equilibrium by providing a lump sum to the looser from the winner, under the assumption of convexity in preferences and in production technology. Following the second theorem, the considerations of equity and efficiency can be separated, since the same efficiency level can be achieved with different distribution of endowments.

The welfare measures that are widely used are the Hicksian compensating and equivalent variations. The compensating variation considers the new equilibrium incomes and prices, and calculates how much must be taken away or added in order to maintain households at their initial utility level. In contrast, the equivalent variation takes the old equilibrium prices and incomes, calculates how much must be added or taken away in order to bring households to their new utility level after the policy change. Using these measures is attractive since they are expressed in monetary units, making them intuitively comprehensible (Bacchetta *et al.*, 2012). Hence, they could be used for interpersonal comparisons of welfare at country and multi-country levels. Aggregating welfare benefits and costs using the compensating or equivalent variations builds on the principle that lump-sum transfers from the winners to the losers is possible, such that the whole economy will be at least as well off as before.

3.3. Modelling labour markets in CGE models

Labour markets are usually differentiated in CGE models to ensure imperfect substitutability based on the skill level or the social characteristics (age, gender, etc.) of workers. Two common issues that necessitate the modeller's attention are how to depict labour mobility across sectors and how does the labour supply responds to changes in wages. This section discusses different options for dealing with these two issues. All the evaluated options have their merits and shortcomings. Subsequently, choosing an option depends on the characteristics of the economy under investigation and on the specific research question.

3.3.1. Modelling labour mobility in CGE models

Labour mobility across sectors is a core aspect of structural changes in the economy. In the CGE literature, it is usually dealt with using one of the two extreme assumptions. Labour is either perfectly mobile across sectors or specific to individual sectors. Perfect mobility of labour implies that workers can move between sectors, until wages in all sectors equalise. Hence, it is assumed that labour is homogenous and should be paid the same irrespective of the sector of employment. However, empirical data show that workers with similar skill level or education who are employed in different sectors receive significantly different wages (Flaig *et al.*, 2013b). This suggests the existence of differences in the marginal productivity of labour according to the sector of employment. Subsequently, different approaches have been developed to account for labour heterogeneity.

A first approach relies on the segmentation of the labour markets and the use of a CET function to transform the labour used in one segment into the labour used in the other segment. Keeney and Hertel (2005) and Banse *et al.* (2013) segmented the labour markets into farm and non-farm segments and used a CET specification to transform farm labour into non-farm labour. The CET specification has the advantage not to assume homogenous labour since labour is differentiated by segments. However, it normalises wages to unity and reallocates labour in terms of efficiency units based on relative wages and the elasticity of the CET function. Hence, the factor market clearing condition becomes opaque as labour is no longer measured in physical units.

A second approach is to account explicitly for labour heterogeneity using a sector-based classification. This approach keeps the market clearing condition transparent since labour is measured in physical units and a unique price definition for each labour class is ensured. A first limitation to this approach is the amount of data required to reach such a level of disaggregation. A second limitation is that for this level of disaggregation, labour becomes sector-specific and there is no possibility to reallocate workers between sectors.

A way-out for the later limitation is the labour mobility function developed by McDonald and Thierfelder (2009). This function allows physical units of labour to transit across sectors based on response elasticities and the ratio between the wage the worker could earn in his sector of origin and the wage this worker could earn in any other sector. Under this approach, labour moves either to pools linked to multiple segments (with perfect mobility within each pool) or between predefined pairs of segments, where each segment represents the labour employed in one or more sectors. Workers who belong to a notionally identical group and working in the same market segment receive the same wage, which reflects a long-term equilibrium situation.

An alternative to the labour mobility function is the proximity index approach of Lofgren and Cicowiez (2017). This approach retains the principle of reallocation of labour to other sectors based on changes in relative wages. However, by contrast to McDonald and Thierfelder (2009), Lofgren and Cicowiez (2017) consider that workers migrating to a new market segment are less productive than workers previously in that segment. Firms consider the gap between efficient and physical labour in their hiring decisions. Accordingly, wages are determined in productivity terms and the productivity of a worker depends on the seniority. Hence, firms pay lower wages (per physical unit) to a new worker than to another one with notionally the same personal characteristics, except seniority in the sector. Although this approach is suitable to capture the reallocation costs and the productivity loss associated with labour mobility, it only fits a short-term perspective. Arguably, in the long-term, new workers will adapt and reach the level of productivity of workers who are already in the sector, and hence they would receive the same wage.

3.3.2. Modelling labour supply response to changes in the wage rates

The assumptions embedded in the model regarding how responsive is the labour supply to changes in wages have several implications for the operation of the labour market. Conventionally, one of two extreme specifications of the labour market is used in CGE models. The supply of labour is either assumed perfectly inelastic (fixed supply) or perfectly elastic (surplus labour). In recent years, an intermediate solution with an upward-sloping labour supply curve has been included in several models. Finally, a fourth way of specifying the labour markets has emerged with the labour-leisure trade-off. This section discusses these four stylized specifications of the labour market conditions and clarifies the theoretical implications for the welfare analysis.

The fixed labour supply specification considers the time allocated by households to the market activities, i.e. activities within the SNA production boundary, and asserts the labour supply to be fixed at that level. While households are the active agents in the labour markets, their decisions are indifferent to changes in the price of labour. Accordingly, the labour supply curve is perfectly inelastic. This specification implies a strong separability between the uses of labour within and outside the SNA boundary. Hence, this treatment is neutral with respect to the welfare generated outside the boundary, since there is no transfer of labour across the boundary. Despite its merit of neutrality to welfare generated outside the boundary and its consistency with standard economic theories that consider households to be the active agents in the operation of labour markets, the assumption of strong separability between uses of labour within and outside the boundary is open to challenges, even in economies with no involuntary unemployment. In fact, it is reasonable to assume that household decisions in labour markets are influenced by changes in the real wages.

The surplus labour specification recognises the presence of involuntary unemployment. It assumes the existence of a spare capacity of labour that can be drawn into employment within the production boundary at zero marginal cost. Accordingly, employment in the market activities can be increased, while keeping the real wages fixed. This assumption is challenged by the empirical evidence that changes in the level of employment are correlated with changes in the real wage rate (Blanchflower and Oswald, 1995). On the other hand, the surplus labour specification is neutral to changes in the welfare generated outside the boundary by assuming labour to have zero opportunity cost outside the production boundary. However, this apparent neutrality renders this specification open to challenges as labour outside the boundary is often engaged in activities producing services for the use of households. This is particularly the case in the developing countries, where there are no unemployment benefits and labour not employed within the production boundary is often engaged in low-productivity activities producing services for the entire household (Aragie et al., 2017). An additional criticism of the surplus labour is that it presumes factors to be the active agents making decisions in the operation of markets. Once the quantity of labour needed in the market activities is determined, part of the surplus labour is drawn into the market from each household in the same proportions as recorded in the base year. However, in standard economic theories, the decision-making agents are the owners of labour, i.e. households, who decide the amount of labour to allocate to the market activities based on changes in wage levels, and based on their respective labour endowments and the utility they each derive from time uses in the non-market activities (McDonald, 2018).

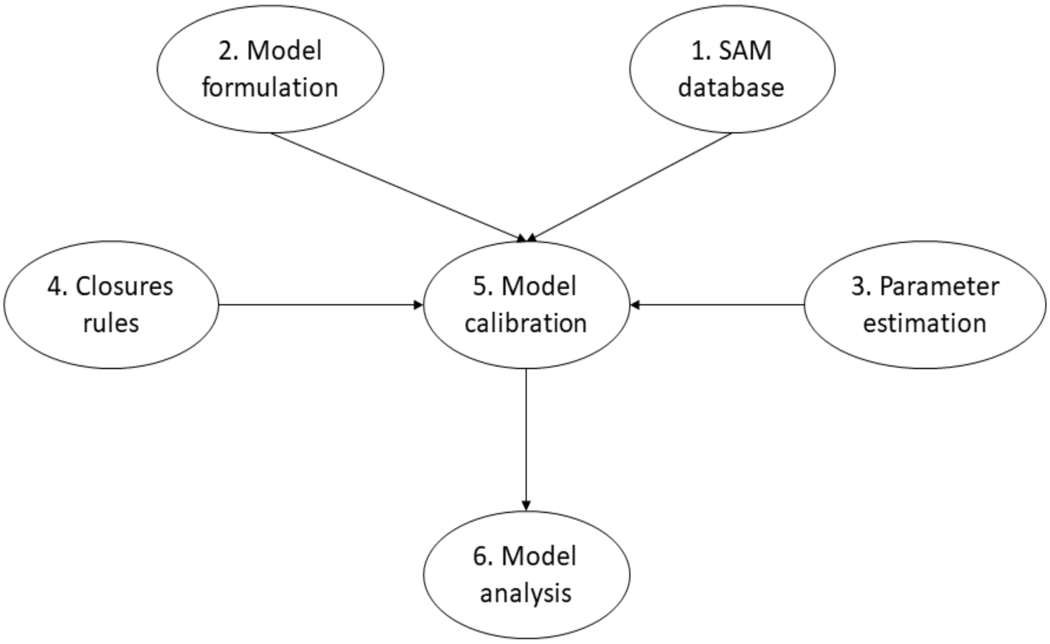
The upward-sloping curve specification derives from the empirical evidence that changes in the wage rates influence the supply of labour within the production boundary. This treatment considers that labour enters the production boundary at a positive marginal cost. However, it implicitly assumes the opportunity cost of labour outside the production boundary to be zero. Hence, this specification is not neutral with respect to the welfare generated outside the boundary. When a transfer across the boundary takes place, the utility forgone outside the boundary is presumed to be zero, while absorption increases as activities within the boundary pay a positive price for the additional labour supplied, which increases labour and household income. Subsequently, part of increases in the measured absorption is realised from the reduction of welfare generated outside the boundary (McDonald, 2018). Moreover, the theoretical and behavioural foundations of the upward-sloping curve are not supported by standard economic theories. Its use may be rationalised with non-competitive theories of the labour market such as the union bargaining power, efficiency wage and labour contract analytical frameworks (Blanchflower and Oswald, 1995). Finally, similar to the surplus labour specification, this specification assumes households to be passive agents in the operation of labour markets, which runs counter standard economic theories.

The labour-leisure trade-off accounts for household use of time within and outside the production boundary. The opportunity cost of labour outside the boundary is explicitly provided in the model. Its value equals the wage rate paid within the production boundary. Since the price of labour across activities either within or outside the boundary is the same, the labour-leisure trade-off specification complies with the "Law of One Price" which is presumed to hold in any price driven whole-economy model. The household utility is defined at full consumption recognising that households do not only derive utility from the consumption of goods and services purchasable from the markets, but also from services they produce for their own use outside the production boundary. The services produced outside the boundary are referred to by the generic term leisure. By defining household labour at full time endowment and household utility at full consumption, this model specification captures the trade-off facing households while allocating time within and outside the production boundary and links their consumption outcomes to the decisions made in the labour markets. This model specification measures the welfare generated on both sides of the production boundary. When transfers of labour occur, the positive and negative welfare effects on both sides of the boundary are recorded. The model specification is consistent with standard economic theories and assumes households and activities to be the active decision-making agents in the operation of labour markets. A critical point of the labour-leisure trade-off is its incompatibility with involuntary unemployment, as labour can always be employed either within or outside the boundary.

3.4. Application of CGE modelling

To apply the CGE theoretical framework to empirical policy experiments, modellers need data that display in a comprehensive way all the interdependencies at play within the economy. For this purpose, they make use of social accounting matrices. The typical steps involved in any applied CGE model are depicted in Figure 3-1.

Figure 3-1. Steps in an applied CGE model



Source: Own illustration

The first two steps (SAM development and model specification) are independent and do not necessarily follow a definite order.

The SAM – step 1 in the diagram – is a framework to organise the data on the structure of an economy and display all fundamental interactions taking place in that economy. It provides the essential data required to operationalise a CGE model. For a CGE application, it may be needed to develop a SAM from scratch. Even when a SAM is available, there is often a need to aggregate or disaggregate some sectors of interest or to update the SAM to a reference year that is more suitable for the analysis. The SAM framework has been presented in Chapter 2 and the construction of a SAM is documented in Chapter 5.

The model formulation – step 2 in the diagram – provides the functional form of the behaviour of each agent in the economy. Most applied CGE models allow intra-industry trade by assuming that goods differ by country of origin, which is known as the Armington assumption. Firms are assumed to maximise profits subject to limited production factors and given a certain technology. Households maximise utility subject to a budget constraint. Only representative households are usually considered, assuming that within each household group, preferences and demand functions are the same. The government's role in CGE models is limited to collecting taxes and making transfers. Therefore, no behavioural function is associated with the government sector. A deeper look into the structure of a CGE model and its behavioural relationships is provided in Section 3.6.

In order to fit the functional specifications of the model with the data, the modeller needs the value of exogenous parameters in addition to the value transactions contained in the SAM – step 3 in the diagram. The exogenous parameters capture the behaviour of economic agents and measure their responsiveness to relative prices and income changes. At least three types of parameters need to be estimated. The first type is the elasticities that govern the substitution amongst the primary factors of production (labour, land and capital). The second is the Armington elasticities to differentiate commodities by country of origin. The third type of parameters determines prices and income elasticities. These three types of parameters are often either taken from existing studies or estimated for specific cases.

The choice of the closure rules – step 4 in the diagram – is another important step in operationalising a CGE model. The closure rules ensure that the model is closed, meaning that there are enough independent equations to explain the endogenous variables. Moreover, the closure rules capture the macroeconomic environment and define the directions of causality in the model. Depending on the chosen closure rules, the way an economy adjusts to a policy shock differs. The choice of closure rules should be guided by a sound theoretical background, as well as by the specific nature of the problem under investigation. In static CGE models, the closure rules relate predominantly to factor markets, investment, government and current account balances (Gilbert and Tower, 2012). Changes in the capital market usually represent different adjustment timeframes. The Heckscher-Ohlin specification implies mobility of capital across industries. In contrast, the sector-specific factor specification assumes the stock of capital in each industry to be exogenous, i.e. fixed. While the Heckscher-Ohlin specification reflects a long-term perspective, the sector-specific factors specification corresponds to a short-term perspective. In the labour market, the neoclassical standard closure assumes a flexible wage rate and full employment of labour. An alternative is to fix the wage rate and flex the level of employment, hence introducing the possibility for labour to be unemployed.

The choice of closures for the saving-investment balance depends on the characteristics of the economy. The modeller can either fix investment and let the balance identity determine savings (investment-driven closure), or fix savings and let the balance identity determine the level of investment (savings-driven closure).

There are different options to close the government account depending on the economic reality the modeller wants to depict. If the government faces a binding budget constraint, the government balance needs to be fixed. Either the government expenditure or income varies to keep the balance. In case the choice is made to let the government's income vary, a tax rate is chosen to adjust endogenously. Often the income tax is chosen for its income distribution effect, which is absent from other tax instruments.

Finally, to close the current account balance that reflects savings/borrowing from the rest of the world two options are often considered. Either the current account balance is fixed and the exchange rate adjusts, or the exchange rate is fixed and the current account is flexible. When a fixed current account is specified, it represents an economy with limited access to foreign credit. This closure ensures that all the welfare effects are kept in the solution period. By contrast, a flexible current account – by allowing extensive foreign borrowing – increases consumption in the current period but does not account for paying back the debt. Hence, the welfare effects are biased in this closure.

The model calibration – step 5 in the diagram – is the process of estimating all parameters that remain unknown, such that together with the value transactions from the SAM and the values of the behavioural parameters, the model is able to reproduce exactly the data of the reference year. This estimation of the unknown parameters could be done empirically if the required data are available. In most CGE applications, the procedure adopted to estimate those parameters is to use the information contained in the SAM. The model calibration is a mathematical procedure, whereby parameters such as shares and scale parameters are calibrated using the SAM coefficients. Subsequently, the benchmark data contained in the SAM are considered to represent the initial equilibrium. Some consistency checks should be incorporated to help identifying possible errors.

When the model calibration is completed and the consistency checks do not reveal any leakage in the system, the model is ready for policy experiments – step 6 in the diagram. The policy change to be simulated should potentially have economy-wide effects on sectors other than the one where the initial shock is implemented. The parameters whose values need to be changed exogenously to implement the policy change as a shock to the model should be identified. While choosing the variables to be turned into parameters, the researcher needs to keep the equality between the number of equations and the number of variables. After running the policy experiments, the model analysis consists in a pairwise comparison between the counterfactual equilibrium and the benchmark (initial equilibrium).

The assessment of welfare changes is usually one of the main outcomes of a CGE model, since the final goal of any policy is to improve people's livelihoods. Welfare is usually measured in terms of Hicksian compensating or equivalent variation. The net welfare is obtained by summing up welfare gains and losses across individuals and across regions. For a comparison across household groups, the welfare effects measured in monetary units tend to be larger for wealthy households. Subsequently, a better basis for comparison across income groups is to use the ratio of the welfare change to the initial household income.

3.5. Typology of CGE models

CGE models differ by their geographical scope, temporal structure and underlying assumptions.

With respect to the geographical scope, it is possible to differentiate between single-country (i.e. single-region) and multi-country (i.e. multi-regional) CGE models. While single-country models are suitable to assess the effects of policy changes and external shocks on the economy of a particular country/region, multi-country models are more appropriate to investigate the welfare implications of global issues.

From the temporal structure perspective, static and dynamic CGE models are available. A static model assesses the effects of a policy shock on the economy at only one point in time, i.e. the results show the difference between two alternative future states of the economy (with and without the policy shock). By contrast, a dynamic CGE involves multiple periods and shows the timepath of the policy effects (Bacchetta *et al.*, 2012). The dynamic group of CGE models can be further differentiated into recursive dynamic and inter-temporal models. While a recursive dynamic CGE model solves a sequence of static equilibria, in which the agents' behaviour is based on backward-looking adaptative expectations, the inter-temporal CGE model is based on forward-looking rational expectations whereby consumers and firms face an inter-temporal utility and profit maximisation function, respectively.

As far as the underlying assumptions are concerned, there are CGE models with perfect or imperfect competition, as well as CGE models with homogenous or heterogeneous firm characteristics.

In the subsequent Section 3.7, the basic structure of the Static Applied General Equilibrium model, version 2 (STAGE-2), which serves as a starting point for the applications run in this thesis is presented. This model belongs to the class of static single-country models. It has been selected because first, the applications conducted in this thesis focus on a single region – the West Bank – and hence, a single country model is more suitable for the analysis. Second, while dynamic models may provide rich insights on the timepath of policy effects, they need to simplify the structure of the economy to remain computationally tractable (Bacchetta *et al.*, 2012). Moreover, dynamic models only matter if the policy shock is expected to affect the inter-temporal behaviour of consumption as well as the flow of investment and changes in the capital stock. Therefore, for the analysis intended in the applications conducted in Chapter 6, Chapter 7, Chapter 8 and Chapter 9 of this thesis, a static model such as the STAGE-2 model is reasonable.

3.6. Basic structure of the STAGE-2 single-country model[2]

The STAGE-2 model belongs to a suite of single-country SAM-based static CGE models. It is developed by McDonald and Thierfelder (2013) and coded in the General Algebraic Modelling System (GAMS) software. The model is based on the microeconomic theory of utility and profit maximisation, and assumes all markets to be in equilibrium. This section presents the core components of the model.

As a static model, the STAGE-2 assesses the effects of a policy shock on the entire economy at only one point in time, i.e. the results show the difference between two alternative future states of the economy (with and without the policy shock). The main features of the STAGE-2 model include: the differentiation between products by origin (Armington assumption), the separation between activities and commodities that permits the modelling of multiple product activities, the explicit treatment of transaction costs (trade and transport margins), a differentiation between competitive imports/exports, commodities that are only imported/exported and commodities that are not traded. In addition, the model relaxes the Harberger convention of homogeneous labour by capturing labour in physical units. Subsequently, heterogeneous labour can be modelled with workers receiving different returns in different activities.

The remainder of this section is organised as follows: the first Sub-section, 3.6.1, presents the behavioural relationships captured in the model. The second Sub-section, 3.6.2, discusses the price definitions and the price normalisation process. The Sub-section 3.6.3 describes the quantity system in the model. The Sub-section 3.6.4 reviews the major accounts in the SAM and highlights the accounting identities underpinning those accounts. Finally, the Sub-section 3.6.5 discusses market clearing conditions and closure rules in the STAGE-2 model. For a detailed documentation of the model equations, the reader can refer to McDonald and Thierfelder (2013).

[2] This section draws on the extended model description for STAGE by McDonald and Thierfelder (2013)

3.6.1. The behavioural relationships in the model

The model uses a combination of linear and non-linear relationships to represent the behaviour of the economic agents that are identified within the SAM. These relationships are illustrated in Table 3.1 where rows are labelled by numbers and columns by letters. As an illustration, the cell (4,C) depicts the behavioural specification of production by activities using factors.

The production structure (4,C) assumes firms to maximise profits using a three-stage production technology. In the first stage, different types of labour are combined to form an aggregate labour input. In the second stage, aggregate labour is combined with capital and land to form a new composite called "value added", while goods are used as inputs to form a composite intermediate good. At the top level, in the third stage, the two composites (value added and intermediate goods) are combined to produce the final output. Different degrees of substitution can be specified at each stage using a Constant Elasticity of Substitution (CES) or Leontief (fixed proportions) technologies. Usually, the different types of labour are considered substitutable in the first stage of the production. At the second stage, the intermediate inputs (1,C) are considered to be used in fixed proportions to form the composite intermediate good, while the natural factors can be substitutable. At the top level, substitutability is also considered between composite intermediate goods and value added.

The domestic output (3,A) is divided between the domestic and export markets, assuming an imperfect substitutability that uses a Constant Elasticity of Transformation (CET) technology (1,I). Hence, the domestic producer allocates his domestic output to the domestic or export market based on relative prices of commodities in the two markets. The model can be specified to fit the small country assumption by assuming the domestic producer to be a price taker. However, this assumption can be relaxed for selected export commodities for which the country might be a large player in the international markets.

Households in the model are assumed to maximise their utility subject to preferences represented by a Stone-Geary function, which is a linear expenditure system (1,E). the domestic demand is satisfied by composite commodities that are formed from the domestic production sold on the domestic market and the composite imports (9,A). Imports and domestic production for domestic market are assumed to be imperfect substitutes (Armington assumption). A CES technology is applied to combine the domestically produced commodities and imports with their respective quantities being determined by their relative prices. In the model, institutions are the owners of factors. Factorial income accrues to them through a functional distribution that is determined in the model. In its simplest specification, quantities of factors supplied by each institution are fixed. Subsequently, the functional distribution is in fixed proportions (5,D), (6,D), (9,D).

Beside the previously listed behavioural specifications, the remaining relationships in the model are linear. All tax rates are declared as variables with scaling factors either declared as variables or as parameters to allow the user to vary them equiproportionately and/or additively. Commodity and activity taxes (7,A), (7,C) are expressed as *ad valorem* tax rates, while income taxes are defined as proportions of the household and enterprise incomes (7,E), (7,F). Import duties and export taxes apply to imports and exports respectively, while sales taxes are applied to all domestic absorption. Production taxes are levied on the value of output by each activity, while activities also pay taxes on the use of specific factors. Factor income taxes are charged on factor income after allowance of depreciation (8,C) and prior to the distribution of residual income to households (5,D).

Households, enterprises and the government are assumed to save a fixed proportion of their disposable income (8,E), (8,F) and (8,G). Enterprise and government expenditures consist of commodity demand (1,F) (1,G), which are assumed to be in fixed proportions in real or volume terms and transfers that are also assumed to be in fixed shares (5,F), (5,G), (6,G). The domestic margins (1,B), (2,A) are transactions between commodities and are retained in fixed shares. The rest of the world makes transfers to domestic institutions (4,I), (5,I), (6,I), and (7,I) that are fixed exogenously. The foreign savings or current account balance (8,I) clears the rest of the world account. Scaling factors are available for a number of key parameters to enable the user to vary them exogenously. For example, technology changes can be introduced by varying the scaling factors associated with the activity-specific efficiency variables. Finally, the model can accommodate a large range of closure rules to allow the user to experiment with various permutations.

Table 3.1. Behavioural relationships in STAGE-2

		A Commodities	B Domestic margins	C Activities	D Factors	E Households	F Enterprise	G Government	H Investment-savings	I Rest of the world	J Total
1	Commodities	0	Fixed technical coefficients	Leontief Input-Output Coefficients	0	Stone Geary Utility function	Fixed exogenously	Fixed exogenously	Fixed share of savings	CET function	
2	Domestic margins	Fixed technical coefficients	0	0	0	0	0	0	0	0	
3	Activities	Domestic production	0	0	0	0	0	0	0	0	
4	Factors	0	0	Three-stage CES production functions	0	0	0	0	0	Fixed exogenously	
5	Households	0	0	0	Fixed shares of factor income	Fixed share of household income	Fixed shares of Dividends	Fixed transfers in real terms	0	Fixed exogenously	
6	Enterprise	0	0	0	Fixed shares of factor income	0	0	Fixed transfers in real terms	0	Fixed exogenously	
7	Government	*Ad valorem* tax rates	0	*Ad valorem* tax rates	Average tax rates	Average tax rates	Average tax rates	0	0	Fixed exogenously	
8	Investment-savings	0	0	Fixed share	Shares of factor incomes	Shares of household income	Shares of enterprise income	Government saving	0	Current account balance	
9	Rest of the world	CES function	0	0	Fixed shares of factor income	0	0	0	0	0	
10	Total										

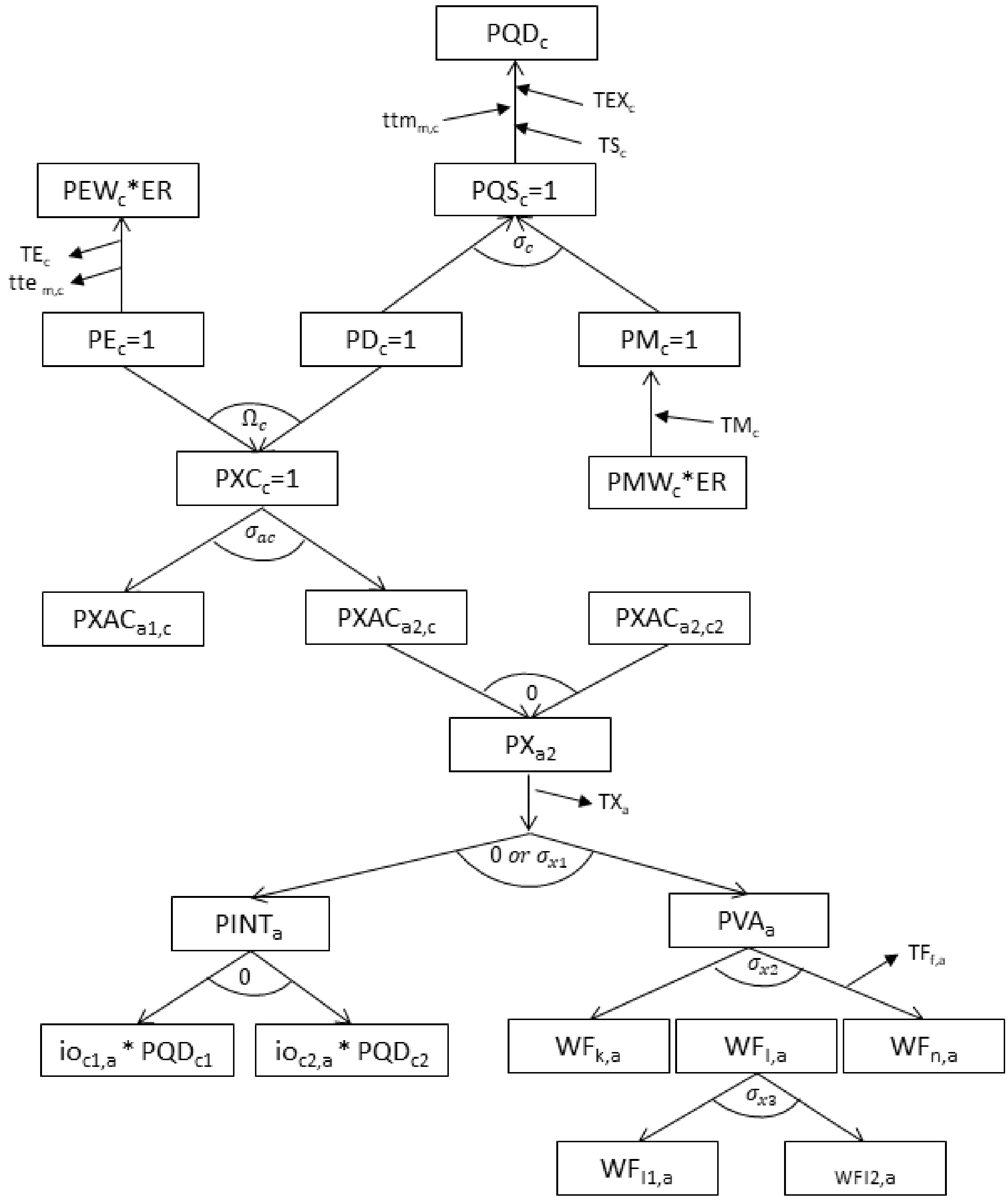
3.6.2. The price system

The price system in the STAGE-2 model is illustrated in Figure 3-2. The domestic consumer prices (PQD) are a composite of the supply prices (PQS), trade and transport margins (ttm), and sales (TX) and excise taxes (TEX). The supply prices are determined by the domestic prices of domestically supplied commodities (PD) and the domestic prices of imports (PM). The domestic prices of imports are expressed in the domestic currency after conversion of the prices in the international markets (PWM) using the nominal exchange rate (ER) and after adding the tariffs (TM). The domestic prices of exports (PE) are obtained after converting the international market prices (PWE) into the domestic currency, and deducing the trade and transport margins used on exported commodities (tte), and the export taxes (TE). The producer prices of commodities (PXC) are determined by the prices of composite exports and the domestic prices of domestically supplied commodities (PD).

In the price system for production, the producer prices of commodities are CES aggregates of activity commodity prices (PXAC), which are themselves Leontief aggregates of composite prices of output by activity (PX). After paying production taxes (TX), the composite prices of output by activity are divided between payments to aggregate the value added (PVA), which is the amount available to pay primary inputs, and the aggregate intermediate input (PINT). The production function at this level can take either a CES or Leontief form, with CES being the default. Total payments for intermediate inputs per unit of aggregate intermediate input are defined as the weighted sums of the prices of the inputs (PQD). Note that the prices paid for inputs in the production process are the same as the prices paid for the final consumption in conformity with the "Law of One Price". Payments to the aggregate value added after subtracting factor use taxes are distributed as returns to natural factors (WF). Returns to labour following the three-stage production structure adopted is decomposed into wages to specific labour categories.

As the model uses a series of linear homogenous relationships, it is only defined in terms of relative prices. Therefore, as part of the calibration procedure, some prices are set to one. The model adopts the convention that prices are normalised at the level of the CES and CET aggregator functions. To ensure that the model is homogenous of degree zero, a price index has to be selected as the numeraire. In STAGE-2, two price indices are commonly set as the numeraire. The first is the consumer price index (CPI), which is defined as the weighted sum of composite domestic consumer prices (PQD) in the current period, with the weights being the share of each commodity in the total demand. The second price index is the producer price index (PPI), which is the weighted sum of the domestically supplied commodities (PD), where the weights are the shares of the value of domestic output in the domestic market.

Figure 3-2. Price system in the STAGE-2 model



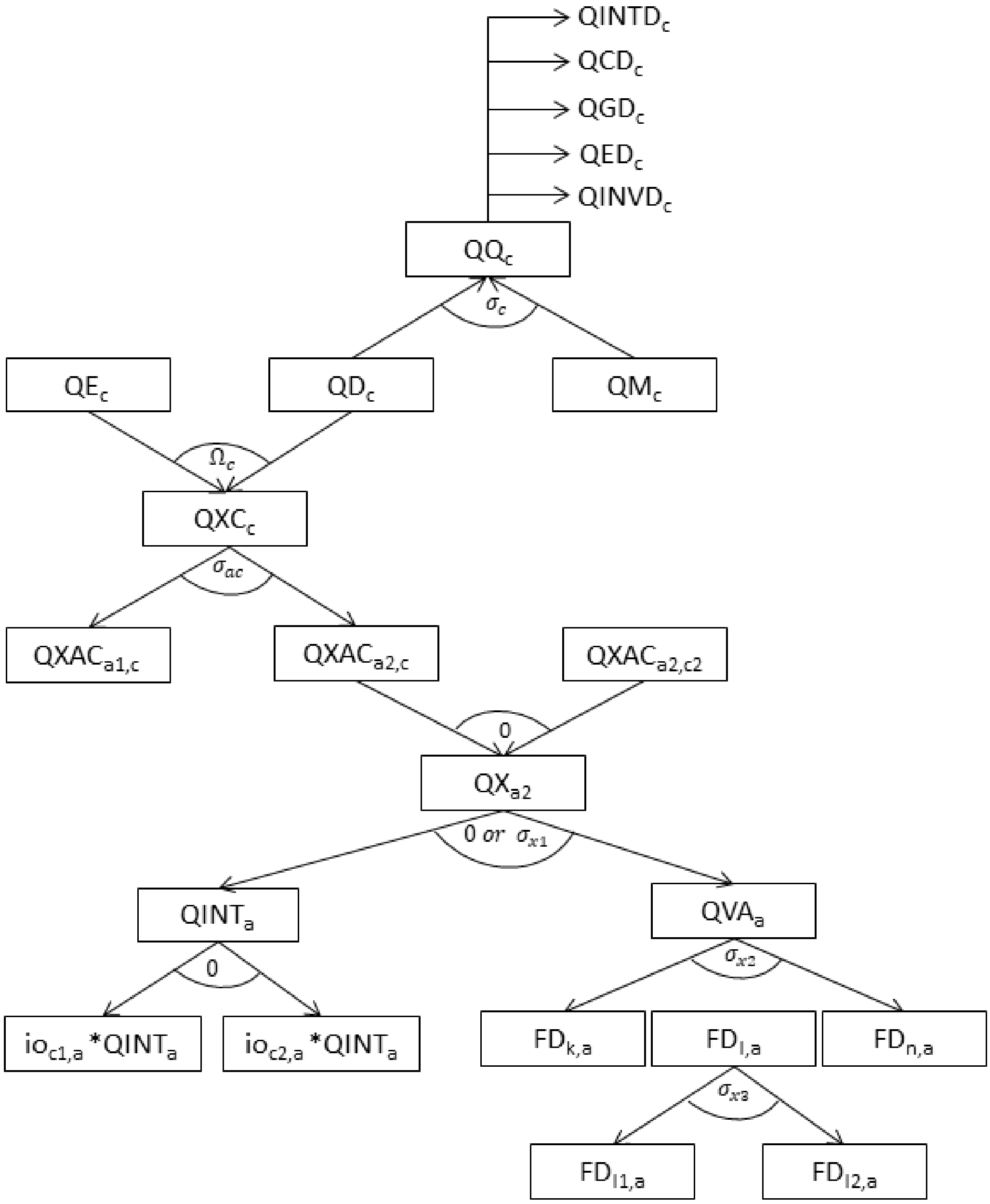
Source: Own illustration

3.6.3. The quantity system

Figure 3-3 provides an illustration of the quantity system in STAGE-2. The composite consumption commodity (QQ) consists of demands for intermediate inputs (QINTD), consumption by households (QCD), government (QGD), and enterprise (QED), gross fixed capital formation (QINVD) and stock changes (dstoc). An equilibrium condition ensures that total demand equals total supply, which is a mix of the domestically produced commodities (QD) and imports (QM). Domestic and imported commodities as imperfect substitutes are represented by a CES technology. The domestic commodity output (QXC) is allocated between the domestic market (QD) and the composite export (QE) under the maintained assumption of imperfect transformation.

The model allows for multiple product activities meaning that domestically produced commodities can come from multiple activities. Hence, the total production of a commodity is defined as the sum of the amount of that commodity produced by each activity. The domestic production of a commodity (QXC) is a CES aggregate of the quantities of commodity produced by different activities (QXAC) which are produced in fixed proportions by each activity. Subsequently, the output of QXAC is a Leontief aggregate of the output of each activity (QX). Following the three-stage production structure adopted, the output of each activity, at the top level of the nesting, is a CES aggregate of the quantities of aggregate intermediate input (QINT) and value added (QVA). At the second level of the nesting, the aggregate intermediate input is composed of different inputs combined in fixed proportions, while the quantity of value added is a CES aggregate of factor demand by each activity (FD). At the lowest level of the nesting, labour demand is a CES function of the specific demand of various labour categories.

Figure 3-3. Quantity system in the STAGE-2 model



Source: Own illustration

3.6.4. The different accounts in the model

Factors

The domestic factors – labour, capital and land – derive income from their employment in the domestic market and abroad. Factor income from abroad is assumed fixed in foreign currency, while factor income from the domestic market is endogenously determined by the forces of demand and supply. The total factor income is distributed to institutions who own the factors in fixed shares, after accounting for depreciation and factor taxes. The model includes the assumption that factor prices are averages. The possibility that payments to notionally identical factors in different activities is captured with the variable “sectoral proportions for factor prices”. These proportions are assumed fixed by default. Foreign factors employed in the domestic economy receive a compensation in fixed proportions of factor income after depreciation and payment of factor taxes.

Factor unemployment is introduced in the model as a mixed complementarity problem. The total supply of a natural factor consists of the total demand and a stock that is currently unemployed. The neoclassical assumption that treats unemployment as a spare capacity is used and hence, firms can employ as much of the unemployed factor they wish without needing to increase wages. When the pool of unemployed factor is empty, then the real wage can increase again and clear the factor market. Thus, two segments of the labour supply function are generated: a horizontal one until the pool of unemployed factor becomes empty, and a vertical one from that point onwards, reflecting full employment.

Households

Households receive income from different sources, including the factors they own, transfers from the government, from enterprises, from other households and remittances from abroad. This income is distributed among households in fixed proportions. Household income is used for consumption of goods and services, for which households are assumed to maximise their utility according to a Sone-Geary function. Part of the income is used to pay transfers to other households, and transfers abroad, which are defined in fixed proportions after deducting direct tax to household income. Household savings are also defined as shares of household income after tax.

Enterprise

The enterprise income is made of factor income – essentially returns to capital – and earnings abroad that are fixed in foreign currency as well as transfers (subsidies) from the government that are fixed in real terms. The enterprise income is spent in fixed proportions on commodities, and transfers (dividends and profits) to households and government. Savings in the enterprise account are fixed shares of the enterprise income after tax.

Government

The government derives income from taxes, factors it owns, dividends from state enterprises, and budget support from abroad. Several tax instruments are specified in the model: income tax, import tariff, export tax, sales tax, excise tax, value added tax, indirect tax on production, factor use tax, factor income tax, to name a few. Each tax instrument is associated with adjustment parameters to allow the modeller to simulate any government intervention by scaling up/down taxes either additively of multiplicatively. The government consumes commodities in fixed proportions, and makes fixed transfers to households and enterprises in real terms, while its savings balance the account.

Trade and transport margins

Trade and transport margins record the costs of delivering a commodity from its source of production to its final consumption place. The model represents margins by the quantity of trade and transport services required to transfer a unit of the commodity to its domestic or foreign consumer. Thus, the quantity of trade and transport services required by the economy is equal to by the quantity of commodities demanded times the quantity of margin services per unit of delivered commodity. The quantity of the commodity required to produce a unit of margin is defined by a Leontief technology where the input coefficient defines the quantities of commodity c required to produce a unit of the margin service. Given the Leontief technology, the unit cost of the margin service is a simple weighted average of the costs of the commodities used in its production.

Saving and investment accounts

Total savings in the economy are composed of household savings, enterprise savings, government savings, and the current account balance. Household and enterprise savings are defined as shares of household, and enterprise income after tax respectively. Government savings (internal balance) and the current account balance (external balance) are defined as residuals that equate income and expenditures in the two respective accounts.

In the investment block, the proportions of the investment demand in the base period are fixed and can be varied using an adjustment parameter. The value of investment demand is equal to the volume of investment demand valued at current prices plus the current priced value of stock changes also defined as fixed proportions of their levels in the base period.

3.6.5. The market clearing equations and closure rules

The market clearing equations in the model ensure the simultaneous clearing of all markets and accounts. There are six relevant markets and accounts: the factor market, commodity market, enterprise, government, capital, and rest of the world accounts. By default, the model adopts a full employment assumption for the factor market, implying that demand equals supply, and any change in the factor demand results in changes in its price. The alternative is that factor prices are fixed and any change in factor demand is met with a change in the pool of unemployed factor. Hence, the factor supply can either be infinite or be capped with an upper bound given the amount of the unemployed factor. In case of a definite pool of unemployed factor, the factor supply curve has two segments: one that is horizontal until the pool of unemployed factor is emptied, and one that is vertical from that point onwards.

By default, factors are also assumed perfectly mobile across sectors, reflecting a long-term time horizon. Alternatively, factors can be assumed to be activity-specific to reflect a short-term perspective. This requires fixing factor demand for the selected factors and relaxing the returns to this factor in different activities. The condition of fixed total factor supply becomes redundant and can be relaxed, while at least one of the sectoral proportions for factor prices must be fixed.

The market clearing condition in the commodity markets require the supply of the composite commodity (QQ) to be equal to the total of domestic demands (QINTD, QCD, QED, QGD, QINVD, and the stock changes). By default, government savings and the current account balance clear the government and rest of the world accounts. Alternatively, the current account balance can be fixed. In that case, the exchange rate is set flexible to clear the rest of the world account. Government savings can also be fixed, and then either government revenues or expenditures must adjust. To allow government revenues to vary, one of the tax rates can be set flexible. To allow government expenditures to vary, the volume of commodities demanded by the government, the value of government consumption expenditure, or the share of government expenditure in total value of domestic final demand should be variable.

To close the enterprise account, the volumes of commodities demanded by enterprises must be fixed. An alternative is to make the volume of enterprise consumption flexible and fix its value or share in total value of domestic final demand.

To clear the capital market, total savings must equal the value of total investment. In order to provide a check on the model specification, a slack variable is introduced in the equation. It returns a zero value when all markets are cleared and the model is fully closed.

The closure rules for the savings-investment account are such that the determinants of either savings or investment must be fixed. The model offers different options to achieve that outcome: fixing savings so that investment adjust can be considered as a neoclassical approach, while fixing investment and letting savings to adjust corresponds to a Keynesian approach.

3.7. Conclusion

A CGE model accounts for all interdependencies in the economy. Hence, it is well suited for the assessment of a policy change or an exogenous shock on the performance and structure of the whole economy through all individual impact channels. The model assumes that all markets in the base period are in equilibrium. When there is an exogenous shock, a new set of prices is obtained, which in turn determines the levels of production, consumption, employment and income in the new equilibrium. Static CGE models, such as the STAGE-2 model, allow the comparative analysis of alternative future equilibrium states of the economy (with and without the policy shock). While this class of models can incorporate a lot of detail about the structure of the economy under investigations, it does not capture the process of adjustment to the new equilibrium. By contrast, dynamic CGE models capture the adjustment path but need to simplify the structure of the economy to remain computationally tractable.

The CGE modelling requires closing the system to avoid "free lunches" and to ensure that the number of equations is equal to the number of variables such that the model can solve. Different closures rules can be adopted. As the choice of closure rules can drive the model results, it is a good practice to state explicitly the closure rules adopted and the reasons behind their choices, in order to let the reader evaluate these choices and reflect on the model results accordingly. The use of alternative closures should often be explored to provide a sensitivity analysis of how different closure choices affect the simulation results instead of pinning faith on a single set of assumptions.

Most CGE applications rely on agent rationality and perfectly competitive markets. Modern literature on behavioural economics demonstrates that individuals may not be fully rational (Aronsson and Löfgren, 2010). Moreover, in many cases, markets are not perfectly competitive. Some products are highly differentiated and their production exhibits increasing returns to scale. Existing firms have a market power that allows them to influence prices. Such complexities are now accounted for in a few CGE applications by incorporating product and firm differentiation as well as monopolistic competition.

In most models where perfect competition is assumed with homogenous products, intra-industry trade is explained by assuming goods to differ by country of origin, also referred to as Armington assumption. Accordingly, each country is the unique supplier of its differentiated product. A consequence of this assumption is the large terms of trade (ratio of a country's export and import prices) effects of trade liberalisation simulations.

A corollary of the Armington assumption in CGE models is that trade expands only at the intensive margin. In other words, the volume of exports increases but neither the set of destinations nor the set of exporters changes. Following liberalisation, trade expands at both intensive and extensive margins. The omission of the extensive margin effects in Armington-type CGE models is the well-known “stuck on zero trade” problem (Bacchetta *et al.*, 2012). This implies that sectors with little or no trade are locked in the pre-existing trade patterns. Similarly, countries with zero or small bilateral trade flows will always have zero or small trade flows, even under significant reductions in trade barriers. Therefore, such model specification does not suit countries with limited trade with the rest of the world that are resulting from trade barriers.

The starting point in a CGE model is that the economy in the base year is in equilibrium. The database provided by the SAM that serves as a benchmark for a CGE model, however, embodies the rigidities and market distortions present in the base year. Assuming that those rigidities and distortions remain in the experiment creates results that should be seen as second-best situations (Bacchetta *et al.*, 2012). Moreover, the quality of the information used to derive the behavioural parameters (elasticities) which are needed to fit the functional form of the model with the data is often questionable. Since the parameters govern the responsiveness of economic agents, they play an important role in determining the outcome of CGE simulations. However, they are often derived from previous studies that may not be related to the country or the topic under investigation. In some cases, these parameters only rely on guesstimates. The usual way to deal with the problem is to provide a sensitivity analysis on a reasonable range of values for selected parameters. Another solution is to assume a probability distribution of all estimated parameters and proceed to simultaneous sensitivity analysis on all of them which results in generating probability distributions for the output variables. However, these approaches also carry some limitations. First, the reasonable range of each parameter or the *a priori* distributions still have to be guesstimated. Second, a full unconstrained sensitivity analysis of all parameters simultaneously produces a spread of results too large for practical use (Bacchetta *et al.*, 2012).

Notwithstanding these limitations, the general equilibrium framework offers several advantages. It provides a rigorous analytical framework to assess the economy-wide impact of policy changes. It imposes income, expenditure and resource constraints to get rid of “free lunches”. It has suitable properties to analyse the welfare effects of policies, and hence is able to provide policymakers with a powerful tool to choose among alternative policies.

4

ECONOMIC CONSEQUENCES OF CONFLICTS: THE CASE OF THE PALESTINIAN ECONOMY

Chapter 4 Economic consequences of conflicts: the case of the Palestinian economy

4.1. Introduction

The Palestinian-Israeli conflict attracts substantial attention in the media for the number of causalities and its political developments. This conflict offers a unique natural experiment field to assess the economic consequences of conflicts as the two economies in this conflict are intertwined in many aspects. Two key areas that best epitomise the relations between the two economies are: the trade regime and the labour market situation. The conflict is also a good case to examine asymmetric relations between two trade partners in conflict, with Palestine being heavily dependent on Israel for both trade and employment opportunities. While there is a substantial literature on the political and violence dimensions of the conflict (e.g. Benmelech *et al.*, 2010; Bhavnani *et al.*, 2011; Jaeger and Paserman, 2008), research on the effects of the security-related restrictions imposed on the movement of goods, services and labour is rather limited (Ihle and Rubin, 2013).

This thesis aims at exploring and quantifying the effects of changes in the conflict-related barriers to trade and labour movements on the West Bank economy. To provide a background for the policy scenarios, which are conduced in Chapter 6, Chapter 7, Chapter 8 and Chapter 9, this chapter reviews the existing literature describing the Palestinian economy, the trade and labour market links with the Israeli economy and the consequences of the conflict.

The next Section, 4.2, considers the evolution of the Palestinian economy in the aftermath of the Six-day war in 1967 until 1987 – the first year of the uprising that resulted in a violent conflict with Israel. The period before 1987 marks the beginning of the economic relations between Israel and Palestine, which developed into an asymmetric economic integration. In Section 4.3, details about the Oslo agreements and especially the Paris protocol on economic relations between Israel and Palestine are reviewed. The Oslo agreements mark the end of the first Palestinian uprising as well as the creation of the Palestinian National Authority to meet the right of the Palestinian people to self-determination and self-governance. The Paris protocol, which is part of the Oslo agreements, is a central piece for understanding the economic relations between Palestine and Israel, and the Palestinian trade and labour market policies.

Section 4.4 provides an overview of the security measures introduced or enforced by Israel following the first Palestinian uprising. While these measures aim at improving security for Israel, they effectively restrict movement of goods, services and people, not only between Israel and the Palestinian territories, but also within the Palestinian territories. The consequences of these measures on the Palestinian economy are reviewed in Section 4.5. Section 4.6 presents the roadmap for peace which promotes the end of the conflict with a two-state solution for the final status. The political roadmap is supported by the international community, and most political leaders in both Israel and Palestine are still committed to the two-state solution. With the political roadmap is associated an economic roadmap which is elaborated jointly by a group of scholars from both Israel and Palestine. This economic roadmap sets the stage for the scenarios implemented in the three applications of this thesis, with the specification of the scenarios provided in the Section 4.7 along with some concluding comments.

4.2. The Palestinian economy from 1967 to 1987: asymmetric integration with Israel

The course of economic development and trade performance in Palestine have been shaped by the unusual links with the Israeli economy. These links are best illustrated by the labour flows and the bilateral trade regime. After the 1967 war, Israel implemented a policy of partial economic integration between itself and the occupied Palestinian territories (Missaglia and Valensisi, 2014). The customs union consisted of a trade regime that was ostensibly free and without customs borders within the geographical area comprising Israel, the West Bank and Gaza from 1972 onwards (Arnon, 2007). Moreover, the Palestinian labour was granted free access to the affluent Israeli economy. Nearly a third of the Palestinian workers were employed in Israel over the 1970s and 1980s (UNCTAD, 2012).

This situation benefitted both sides. From the Israeli perspective, the Palestinian workers are a cheap source of labour. Wages for Palestinian workers in Israel are 20 – 40% lower than those of Israeli workers for the same jobs (Arnon and Bamya, 2007). Moreover, the Palestinian labour hardly competes with the Israeli labour because most of the Palestinians working in Israel are concentrated in a few sectors, where the domestic Israeli labour supply falls short of demand (Rosenhek, 2006). From the Palestinian perspective, employment in Israel is an important source of income that used to generate more than a quarter of the Palestinian Gross National Product (Farsakh, 2002). The Palestinian average wage in Israel is substantially higher than wages in the domestic market. Moreover, employment in Israel is an important spillway for the growing Palestinian labour force as growth in the domestic labour demand has been insufficient to absorb the rising labour force (Kock *et al.*, 2012).

However, this economic integration is widely acknowledged as asymmetric as all decisions were made by Israel, and predominantly served the Israeli interests (Dessus, 2004). While Israeli products benefitted from free access to the Palestinian markets, Palestinian exports to the Israeli markets were subject to strict regulations (Botta, 2010). The development of a productive capacity in the Palestinian economy was held back by restrictions and regulations of different sorts (Botta, 2010). Palestinian entrepreneurs had to apply for licenses from the Israeli authorities before initiating economic activities, and were confronted with uncertainty in the legal and tax frameworks. The expansion of the Palestinian agricultural and industrial sectors was restricted by limitations on the use of water and other natural resources (Dessus, 2004). The Israeli authorities also discouraged Palestinian initiatives that had the potential to compete in the Israeli market with the existing Israeli firms (UNCTAD, 2009). Moreover, Palestinian production for the domestic market was undercut by economies of scale that are realised by the technologically advanced Israeli manufacturers (Naqib, 2003). Subsequently, the Palestinian economy evolved into a captive market for the Israeli products and developed structural trade deficits with Israel.

The trade dependency of Palestine on Israel is best illustrated by the shares of Israel in the Palestinian imports and exports. As of 1987, 90% of the Palestinian import of goods came from Israel, and 75% of its exports went to Israel (Kanafani, 2001). The asymmetric nature of the Palestinian-Israeli trade relations is reflected in imports to Palestine making 11% of the Israeli exports and the Palestinian exports making a mere 2% of the Israeli imports in 1987 (Kanafani, 2001; World Bank, 2017a). Hence, the Palestinian trade deficit amounted to 50% of GDP, of which the quasi-totality was with respect to Israel (UNCTAD, 2009). This large trade deficit was primarily financed by the labour income earned in Israel. Subsequently, the Palestinian economy developed a high dependency on the Israeli labour market. Although the Palestinian employment in Israel improves household income in Palestine as most of the income earned in Israel is repatriated and consumed domestically (UNCTAD, 2016), the employment of Palestinians in Israel negatively affects the domestic production and exports by exerting an upward pressure on domestic wages and prices. Because of higher reservation wages, there are less candidates for low-wage jobs in Palestine. Moreover, the high reservation wages reduce the attractiveness of the Palestinian economy to investors or technology that would increase productivity (Aix Group, 2004).

4.3. The Palestinian first uprising and the Oslo agreements

The asymmetric market relations with Israel and the various administrative restrictions combined with a resentment against the occupation ultimately triggered the first Palestinian uprising, lasting from 1987 to 1993. Following the uprising, it became clear that the nature of the economic links between Israel and Palestine needed re-evaluation. After a process of political negotiations aimed at ending the hostilities and fulfilling the right of the Palestinian people to self-determination, the Oslo agreements were signed in 1993, providing an official recognition of the Palestinian Liberation Organisation (PLO). Following the political agreement, an economic agreement known as the Paris Protocol[3] was signed in 1994 between the government of Israel and the PLO. This protocol was initially agreed for a transitional period of five years (1994 – 1999).

The vision of the protocol was to create favourable conditions for the development of the Palestinian economy through three channels. The first is a free access for the Palestinian labour to the Israeli labour market. The free movement of labour to Israel would continue to provide the Palestinian households with substantial income, while creating opportunities for the Palestinian economy to reach full employment. The second is a transfer of the tax revenues that are collected by Israel to the Palestinian National Authority (PNA). This mechanism, known as tax clearance, aimed at providing the new Authority with an immediate source of revenue while building the internal capacity to operate the institutions of a state (Aix Group, 2005; Frisch and Hofnung, 1997). Finally, the third channel is the considerable aid pledges by donor countries and organisations to support the financing of infrastructure and investment within the Palestinian economy (Arnon and Weinblatt, 2001).

The protocol, while formalising the economic relations between Israel and Palestine as two distinct entities, did not entail any structural break with respect to the pre-Oslo period (Dessus, 2004). During the negotiations, the architects of the Protocol avoided difficult issues of sovereignty, such as the creation of a Palestinian state with full control of external borders and ownership of fiscal and monetary policies, which were deferred to the final status negotiations. Instead, an interim agreement was designed in a way that the two economies would coexist under Israeli-controlled external borders (Arnon and Weinblatt, 2001). The protocol is imperfect in many regards, in part due to its transitional nature and in another part due to the asymmetry of power between the two parties (Missaglia and Valensisi, 2014). In contrast to many economic integration agreements, which give more weight to the interests of the smaller parties than their relative economic power would suggest, the customs union between Israel and the Palestine continued to reflect the Israeli customs and was not bilaterally coordinated (Vaggi and Baroud, 2005). While it recognised that the two parties might have different interests and priorities, it only offered the Palestinians limited policy space. The PNA could only set tariffs on a few imported goods and within certain limits (World Bank, 2002).

The Protocol provisions also granted Israel the right to amend the common tariff book, with the only restriction being to give the PNA prior notice of the change (UNCTAD, 2012). While the Protocol provisions grant the PNA the possibility to enter into bilateral trade agreements with other countries, the implementation of the agreements signed by the PNA is undermined by the lack of Palestinian control over its external borders (World Bank,

[3] The terms "Paris protocol" and „Protocol" are used interchangeably in this thesis

2008). The only working trade agreements in Palestine are those signed by Israel with other countries and thus benefitting Palestine because of being in a customs union with Israel. Most of these agreements involve tariff-rate-quotas. However, the quotas in Palestine are not determined by the PNA alone. They are instead the outcome of negotiations with the Israeli Trade Authority. As of 2012, the Palestinian quotas for imports from countries outside the customs union were set at 20% of the Israeli pledges (MAS, PCBS, PMA, 2013). A consequence of Palestine's limited access to global markets is a trade diversion and a continued dependency on Israel (Astrup and Dessus, 2005). Between 2007 and 2011, trade with Israel accounted for 70 – 90 % of Palestinian total trade, and the trade deficit with Israel accounted for 75% of the Palestinian total trade deficit (Elkhafif *et al.*, 2014).

4.4. The Israeli security measures: closure policy and work permit system

The roots of the closure policy implemented by Israel go back to the Six-Day war of 1967. In the aftermath of the war, the Palestinian territories were declared closed military areas with restricted mobility of goods and persons. Later in 1972, in order to promote the integration of the Israeli and Palestinian territories, Israel issued general exit orders allowing free mobility into Israel and East Jerusalem as well as between the West Bank and Gaza (Akkaya *et al.*, 2008). This policy of free mobility within the geographical area comprising the Israeli and Palestinian territories was halted in the advent of the first Palestinian uprising of 1987. From 1989 onwards, the closure policy was tightened and was progressively enforced by a series of checkpoints and roadblocks.

There are three categories of closures. The first consists of internal closures which restrict the mobility of goods and people inside the West Bank[4]. The second category is composed of external closures which restric movements between the West Bank and Gaza, and from Palestine to Israel, the settlements and East Jerusalem. The third category consists of external international closures at the border between the West Bank and Jordan, and between Gaza and Egypt. Closures are often declared on short notice and for different periods of time (Ihle and Rubin, 2013). The building of a physical barrier that began in September 2000 marked a further step in the move towards economic and physical separation between Israel and the Palestinian territories (Del Sarto, 2014).

For nearly all movement outside their greater area of residence, Palestinians are required to obtain permits to cross the checkpoints. For movement within the West Bank, permit requirements are lower than for movement between the West Bank and Gaza, from the

[4] Internal closures in Gaza were completely removed following the Israeli unilateral withdrawal from Gaza in 2005.

Palestinian territories into Israel, the settlements and East Jerusalem (World Bank, 2007). Permits to Palestinians are issued for purposes of work, trade, medical treatment, etc. Requirements for the permits can change from one day to another day, according to the Israeli political objectives and perceived security risks (Fischer *et al.*, 2001).

As the functioning of the labour market is a focus in this thesis, more attention is devoted to the work permit system. The individual work permit system was first introduced in 1991. It requires every Palestinian who wants to work in Israel to be equipped with a permit. Work permits are granted to Palestinians who get a security clearance from the Israeli military establishment and have in advance a request of employment from an Israeli employer. The security clearance is bound to personal status criteria presumed to reduce the likelihood of the Palestinian worker to be involved in attacks against Israelis. The conditions for this security clearance change frequently without prior notice. At the height of the second Palestinian uprising (2001 – 2004), the criteria required the Palestinian worker to be married with children, and aged more than 35 years (Etkes, 2012). As of 2014, the main criteria are to be married and aged more than 24 years (COGAT, 2014).

The work permits restrict the number of Palestinian workers in the Israeli economy and limit their employment opportunities to specific sectors through a quota system. Most Palestinians employed in Israel are confined to the low-skill and manual jobs in sectors such as construction, agriculture, some low-tech industries and services (Miaari and Sauer, 2011). The number of work permits issued is based neither on the supply nor on the demand for Palestinian labour in the Israeli economy. As a result, a black market for Palestinian labour in Israel and the settlements developed mainly in the West Bank. Between 2005 and 2015, on average 38% of Palestinian workers in Israel and the settlements were unpermitted (PCBS, 2016a).

The closure policy as well as the work permit system are unilaterally decided and implemented by Israel without coordination with the PNA. When the conflict reaches its heights, Israel imposes – at times – complete closures, where even permit holders are not allowed to clear the internal or external checkpoints (Rubin and Ihle, 2016). This situation is a violation of one of the principles of the Paris Protocol, according to which the two parties pledged to maintain the normality of labour movement between them and to coordinate the flows of goods and services (Elkhafif *et al.*, 2014).

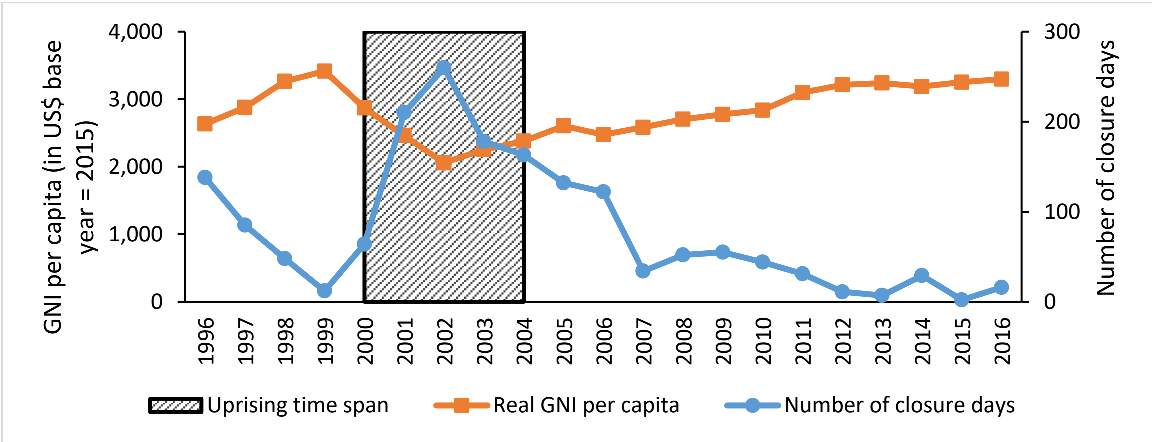
4.5. Consequences of the restrictions and the economic environment in the post-Oslo era

The Israeli security measures impose costs on both the Israeli and the Palestinian economies. The Israeli economy faced a shortage of low-skilled labour. Initially, the Israeli government has responded by importing more foreign labour, especially from Asia. While this policy effectively reduced the negative effects of the restrictions on the Israeli economy, substitution between Palestinian and other foreign workers is far from perfect. The Palestinian workers enjoy a preference in the Israeli labour markets over other foreign workers, because they are more experienced and have a longer employment history with Israeli employers (Arnon and Weinblatt, 2001). Moreover, in contrast to Palestinian workers who commute on quasi-daily basis, the other foreign workers require a longer period of stay. The likelihood of other foreign workers settling permanently in Israel is also viewed by large segments of the Israeli society as a potential threat to the Jewish character of Israel (Rosenhek, 2006).

While the effects of the restrictions on the Israeli economy are relatively small, they are considerable for the Palestinian economy, undercutting its current and future development capacity (Akkaya *et al.*, 2008). Figure 4-1 shows a striking negative correlation between the real Gross National Income (GNI) per capita in Palestine and the number of closure days over time. The period after the Oslo agreements came into force (1996 – 1999) is characterised by a lower intensity of the conflict, a downward trend in the number of closure days and an increasing real GNI per capita in Palestine. However, since the outbreak of the second Palestinian uprising[5] in late 2000, the conflict reached new heights with intensified closures, and the economic recovery was halted. Although the uprising ended officially in 2004, the number of closure days decreased significantly only from 2007 onwards, with a later improvement in the Palestinian GNI per capita.

[5] The second Palestinian uprising is attributed to the failure of the Camp David negotiations on a final status and the visit of the Israeli opposition leader Ariel Sharon to the Temple Mount, a move seen by Palestinians as a provocation.

Figure 4-1. Evolution of real GNI per capita (in US$ with 2015 as base year) and the number of closure days, 1996 - 2016

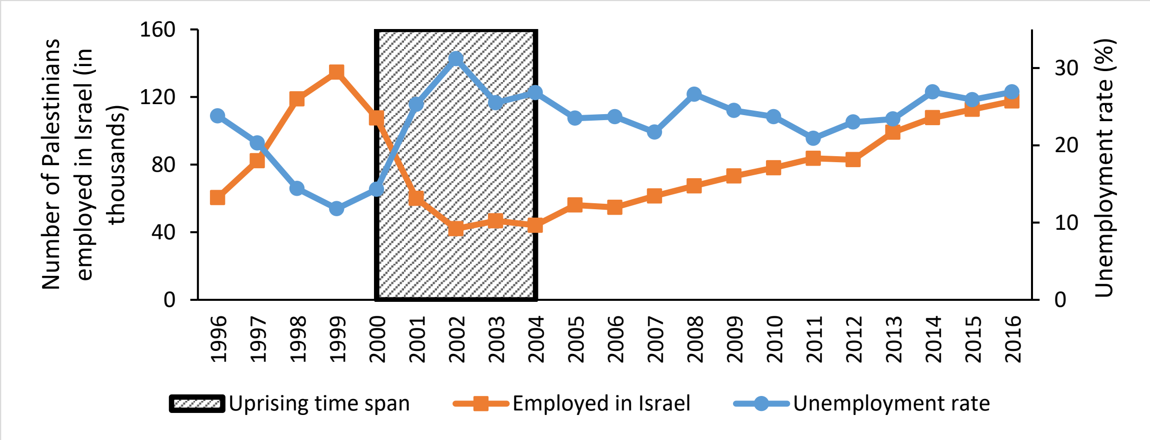


Source: B'Tselem, 2017; PCBS, 2017; UNCTAD, 2009

The Israeli restrictions exert both direct and indirect effects on the Palestinian income. The direct effect takes place through the loss of labour income from Israel. As illustrated in Figure 4-2, by the end of the second Palestinian uprising in 2004, Palestinian employment in Israel has been more than halved as compared to its level in 1999. Subsequently, income for Palestinian households was strongly affected and poverty rates inside the Palestinian territories increased sharply (UNCTAD, 2012).

Figure 4-2 also highlights the correlation between employment in Israel and unemployment in the Palestinian territories. At the height of the uprising, between 2001 and 2004, the unemployment rate in the Palestinian territories stood at 27% on average, more than double its level of 1999. Following the end of the uprising, employment of the Palestinian labour in Israel resumed progressively, though its level in 2016 still lags behind the *pre-intifada* level of 1999. Despite the slow recovery of the employment in Israel, the unemployment rate remains fairly constant around 25%, well above its *pre-intifada* level of 1999. The high unemployment rate in Palestine since the tightening of the Israeli restrictions points to the limitation of the domestic market to absorb the growing labour force. In response to this problem, the Palestinian National Authority developed into a fast expanding public sector with employment in the public sector serving as a safety net to fill the vacuum left by the reduced employment opportunities in Israel and the contraction of the private sector (World Bank, 2011). As the payroll and activities in the public sector are largely supported by international aid, the Palestinian economy developed a new dependency on aid.

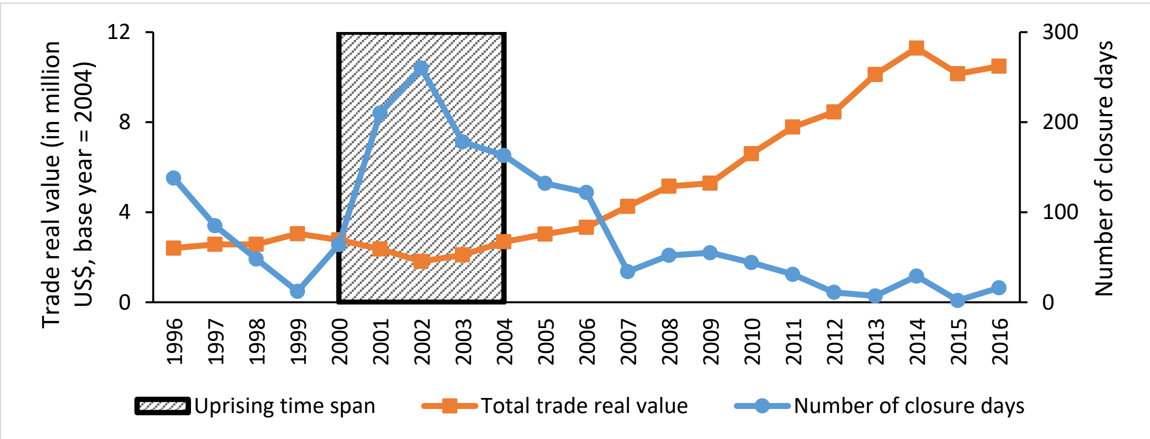
Figure 4-2. Evolution of the number of Palestinians employed in Israel and the unemployment rate in Palestine, 1996-2016



Source: PCBS, 2017d, 2000

The indirect effects of the restrictions on Palestinian income are related to the disruption of Palestinian trade flows, investment and domestic production due to the intermittent closures. The transaction costs induced by the closures for both Palestinian importers and exporters weaken the competitiveness of Palestinian products in the international markets (Eltalla and Hens, 2009). As illustrated in Figure 4-3, there is a strong correlation between the number of closure days and the total Palestinian trade (import + export) valued in real terms. Between the last year before the uprising (1999) and the height of the uprising (2002), which has seen the highest number of closure days so far, the Palestinian total trade value was cut by 40%. In the following years, as the number of closure days decreased, Palestinian trade resumed strongly.

Figure 4-3. Evolution of Palestinian total trade value in real terms (in million US$ with 2004 as base year) and the number of closure days, 1996 - 2016



Source B'Tselem - Israeli Information Center for Human Rights in the Occupied Territories, 2017; PCBS, 2017c; UNCTAD, 2009

Besides its external trade, the Palestinian internal trade is also hampered by the closures. In the sole month of November 2004, more than 600 physical barriers (checkpoints, roadblocks, and trenches) were reported in the West Bank, making about 10 barriers by square kilometre (Akkaya *et al.*, 2008). These physical barriers dramatically increase transaction costs for the Palestinian internal trade. For example, the cost of transporting products between Nablus and Ramallah (both in the West Bank) increased five-fold between 2000 and 2005 (Eltalla and Hens, 2009). Moreover, the uncertainty of closures prevents traders from moving products, especially locally-produced agricultural products, from the production site to major cities within the West Bank, causing high price differentials in retail prices between areas that are relatively close (World Bank, 2011).

The connection between the West Bank and the Gaza strip was completely shut down, preventing trade between the two Palestinian territories (Rubin and Ihle, 2016). Access to crossing points to Israel and to Jordan also faced regular closures. Labour movements in the internal market are also significantly affected. By fragmenting the Palestinian internal labour market into enclaves cut off from one another the closures restrict the movement of labour and contribute to the high unemployment in Palestine. The direct loss of labour income in Israel and the indirect loss to the Palestinian trade due to the closures between 2000 and 2005 are estimated to $ 8.4 billion, i.e. twice the size of the Palestinian GDP in 1999 (UNCTAD, 2009).

The poor performance of the Palestinian economy in the post-Oslo period is also attributed to the unbalanced design of the Paris Protocol and the lack of an effective monitoring body (Kanafani, 2001). This is a classic case of an imperfect contract whereby a party can violate the agreement with no significant consequence. The unilateral imposition of frequent restrictions on the movement of labour and goods by Israel is an illustration of the asymmetry of power between the two parties (Fischer *et al.*, 2001).

Another violation of the Protocol's provisions is the frequent withholding of the tax revenue collected by Israel on behalf of the PNA. Between 1997 and 2015, the Palestinian revenue withheld by Israel totalled more than USD 3 billion, and the withholding period lasted between one month and two years (UNCTAD, 2015). Withholding the clearance revenue, which accounts for 75% of the PNA's total revenue, weakens the fiscal position of the PNA and increases uncertainty in the economy, which is detrimental to investment as well as the overall economic activity (Fernández-Villaverde *et al.*, 2015). Furthermore, the protocol did not provide for the transfer of taxes on indirect imports from other countries via Israel, resulting in significant fiscal losses to the PNA (Fjeldstad and al-Zagha, 2004).

The protocol did not entail any structural break to the asymmetric economic relations between Israel and Palestine. As of 2016, 56% of Palestinian imports originate in Israel and 83% of the Palestinian exports went to Israel. However, from the Israeli perspective, the

Palestinian imports only account for 5% of the Israeli exports and the Palestinian exports account for a mere 1% of the Israeli imports (PCBS, 2016a; World Bank, 2017a, 2017b). Compared to 1987, the trade deficit with Israel more than tripled. The Protocol also failed to provide the newly created Palestinian Monetary Authority with the power to issue an independent currency. The absence of its own currency deprives the PNA of seigniorage revenues that could amount to up to 4.2% of the Palestinian gross national income (UNCTAD, 2009). The lack of a national currency also removes options from the PNA to use monetary policies to address specific economic needs and external shocks (IMF, 2013).

In conclusion, the desired outcome of rapid growth of the Palestinian economy envisioned in the Oslo agreements – and particularly in the Paris protocol – did not materialise (Astrup and Dessus, 2001). Among the three channels which are supposed to bring economic growth and lift the living standards of the Palestinian populations, only the international aid flow was sustained at reasonable levels, though below the pledges (Arnon and Weinblatt, 2001). The free movement of labour was altered by the permit system and the closure policy. The transfer of tax collected to the PNA also suffered from frequent withholding episodes reducing the availability of public revenues and complicating the planning and implementation of a coherent public expenditure policy (UNCTAD, 2009). Subsequently, the living standards of the Palestinian population regressed in the post-Oslo period and economic growth was weak and unstable.

The Paris protocol was designed for a temporary period of five years but has been in place for more than two decades and still governs the Palestinian trade relations with Israel and with the rest of the world. Under the current situation, the Protocol is outdated and no longer addresses the challenges faced by the Palestinian economy (UNCTAD, 2016). A final political settlement to generate a more balanced agreement for long-term healthier economic relations between Israel and Palestine may contribute to improving the situation.

4.6. Pathway towards a two-state solution

The roadmap for peace supported by the Middle East Quartet (US, EU, Russia and the UN) provides for three phases that would ultimately lead to a final solution to the conflict. Phase I (December 2002 to May 2003) includes the end of violence by both sides, the cessation of settlement activities by Israel and a comprehensive security reform by the Palestinian Authority. In Phase II (June to December 2003), a Palestinian state with provisional borders and a new constitution should be established. Finally, phase III (2004 – 2005), should foresee the conclusion of a permanent status agreement and the creation of a sovereign Palestinian state with final borders. However, the roadmap reached a deadlock early in the process as neither Palestinians nor Israelis fulfilled the requirements of Phase I.

According to a group of scholars and observers, the failure of the roadmap is partly attributed to its definition solely in political terms, while a clear vision of the economic arrangements in a final status associated with Phase III could provide momentum for the implementation of the content of Phases I and II (Aix Group, 2004). As most officials in both Israel and Palestine are still committed to the two-state solution, and as the international community has reaffirmed its commitment to the two-state solution, in the UN Security Council's Resolution 2334 of December 2016, research-based evidence is needed to provide a clear vision to the economic arrangements in the final status.

Among scholars and observers, there is a wide consensus that the final status needs to entail the creation of economic borders and to grant the Palestinians full control over their trade and monetary policies (Malul *et al.*, 2008). While promoting independence in economic policy-making, the final arrangements should acknowledge the economic interdependence (Aix Group, 2004). With respect to labour markets, the Palestinian employment in Israel is likely to remain sizeable, at least in the short-term. In the long-term, i.e. in a final status perspective, a group of Israeli and Palestinian academics and experts elaborated the "Economic Roadmap" where they call for a restored flow of Palestinian workers into Israel that is stable, predictable, and coordinated with the PNA, with security restrictions kept at the minimum necessary (Aix Group, 2004). With respect to trade, independence of policy-making means for Palestine an exit from the customs union with Israel. Subsequently, the Palestinian authorities could choose among several trade options including: a free trade area with Israel, a non-discriminatory liberal trade regime, or treating Israel the same way countries with no preferential trade agreement with Palestine are currently treated.

4.7. Conclusion

The Palestinian economy is asymmetrically linked to that of Israel. The two economies coexist within a customs union that was formalised by the Paris protocol. This customs union is largely based on the Israeli rules and, due to structural differences between the two economies, those rules are not favourable to the Palestinian economy. Moreover, the work permit policy and closures introduced by Israel – as security measures – have altered the flow of the Palestinian workers and the goods to and through Israel with substantial negative consequences on both the employment and economic development in Palestine.

Several Palestinian and Israeli experts argue that for a permanent solution to the conflict, the establishment of a sovereign Palestinian state, which would eventually have full control over trade and monetary policies, as well as a restored flow of Palestinian workers to the Israeli economy are needed. However, few studies were designed to quantify the effects of the required changes in trade and labour market policies on the Palestinian economy. This thesis aims at filling that gap by presenting four CGE applications with policy simulations, which are focusing on West Bank trade and labour markets, in order to identify political and administrative options for the Palestinian National Authority.

In the first application, Chapter 6, the effect of a return of Palestinian employment in Israel to its *pre-intifada* level of 1999 is investigated under different model specifications. This application aims at identifying which model specification fits the West Bank labour markets and under which conditions.

In the second application, Chapter 7, the short-term effects of changes in the employment of Palestinians in Israel are investigated, assuming segmented factor markets and the existence of a surplus labour. Four counterfactual scenarios are simulated. The first scenario considers a return of Palestinian employment in Israel to its *pre-intifada* level of 1999 while keeping its composition as in the base year of 2011. This corresponds to an increase in Palestinian employment in Israel by 36%. The second scenario contemplates a return of Palestinian employment in Israel to its 1999 levels with the additional labour being only sourced from males who are eligible for a work permit in Israel. The third scenario increases Palestinian employment in Israel to its 1999 levels while increasing the supply of the labour force assuming labour previously outside the labour force would have incentives to participate the labour force. The last scenario reduces the number of Palestinian workers in Israel by 36%, which corresponds to the assumption that Israel tightens further the access to its market for Palestinian workers.

The third application, Chapter 8, investigates the long-term effects of a return of Palestinian employment in Israel to its 1999 levels. To this end, a mobility function is included in the model and the labour-leisure trade-off specification is used to model the labour market conditions.

Finally, the fourth application, Chapter 9, assesses the effects of changes in the trade regime. Two trade options are simulated, assuming an exit from the customs union with Israel and trade policy in the West Bank being solely determined by the Palestinian authorities. The first scenario is the elimination of tariffs on imports from all trade partners, and the second scenario simulates the imposition of high tariffs on imports from Israel, assuming that Israel is treated the same as countries with no preferential trade agreements with Palestine. Moreover, the performance of three exchange rate regimes is compared in order to inform the choice of a monetary policy that a sovereign Palestinian state with its own currency may want to pursue.

For all four applications, a unique and comprehensive social accounting matrix for the West Bank described in the next chapter is used.

5

A SOCIAL ACCOUNTING MATRIX FOR THE WEST BANK[6]

[6] Parts of this chapter have been published as a working paper: Agbahey, J., Siddig, K., Grethe, H., 2016. A 2011 Social Accounting Matrix for the West Bank with detailed representation of households and labour accounts. Berlin: Humboldt University of Berlin, Department of Agricultural Economics, Working Paper No. 93/2016, p.69.

Chapter 5 A social accounting matrix for the West Bank

5.1. Introduction

The development of a comprehensive database for the West Bank, which can be used as a benchmark for simulation models, meets the first research objective of this thesis. The newly developed Social Accounting Matrix (SAM) fills two gaps. First, previous SAMs for the Palestinian territories by Astrup and Dessus (2001), Bayar (2013), and Missaglia and Valensisi (2014) are highly aggregated, especially with regard to household, factor and activity accounts. The nature of the interaction between the Palestinian and Israeli economies and the complexity of the labour and commodity movements between them require a SAM with detailed representation of labour and household accounts, as well as the production structure to capture the implications of changes in labour movements on the Palestinian economy. Second, the previous SAMs merge the two Palestinian territories, the West Bank and Gaza. Given the empirical evidence that movements of goods, services and labour with Israel are limited to the West Bank since the Gaza blockade in 2007, it is reasonable for the purpose of this thesis to focus exclusively on the West Bank.

Since the development of the first SAM for the United Kingdom by Stone in 1962, SAMs have been constructed and used extensively for policy analysis (Round, 2003). The SAM for the West Bank developed in this thesis has several distinctive features which are presented in the next Section, 5.2. For the SAM construction, a top-down approach – as suggested by Reinert and Roland-Holst (1997) – is followed. First, a macro-SAM including only 15 accounts is assembled and estimated. The steps involved in the construction of the macro-SAM are documented in Section 5.3. Afterwards, the macro-SAM is disaggregated into a detailed SAM comprising 376 accounts. The selection of the disaggregation criteria and the steps involved in constructing the detailed SAM are documented in Section 5.4. Section 5.5 describes the structure of the West Bank economy in light of the SAM, while Section 5.6 draws conclusions and provides an outlook on the caveats for improving the quality of the resulting SAM.

5.2. Main features of the SAM for the West Bank

Compared to the existing SAMs developed for Palestine, the newly developed SAM has various unique aspects as follows:

1. It focuses on the West Bank, which is currently the only Palestinian territory with workers employed in Israel, while other SAMs consider the whole Palestine – i.e. the West Bank and Gaza together.

2. It is much more disaggregated as it comprises 376 accounts. Such a level of detail enables future users to aggregate this SAM to one or more alternative classifications. The list of this SAM accounts is provided in Appendix 2.

3. It includes 83 commodity groups and 49 activity sectors. The separation between activities and commodities allows for an activity to produce several commodities and for a commodity to be produced by several activities. It also enables the valuation of income and expenditure flows in the activity accounts at producer prices, while the flows in the commodity accounts are valued at market prices.

4. It recognises the importance of the agricultural sector in the West Bank through its explicit representation of agriculture by eight commodities and four activities.

5. It provides comprehensive information on transaction costs represented by three margin accounts respectively for wholesale, retail trade and transport.

6. It includes a separate account for non-profit institutions serving households (NPISH). These institutions play a significant role in the West Bank economy, which heavily relies on the services they provide. The NPISHs are depicted in the SAM in two ways. First, as an institution, they consume goods and services and make transfers to households. Second, as a productive activity, they employ labour and capital to produce services that are consumed by the households.

7. To our knowledge, this is the first SAM to include an explicit account for the religious transfer payments that flow from the rich to the poor households (*Zakat*). In most Muslim-majority regions, like the West Bank, *Zakat* contributions are voluntary, though considered in principle as a religious charitable obligation. The size of the contributions is not negligible, as it is customarily about 2.5% of a household's total savings and wealth above a certain minimum.

8. The West Bank SAM that is constructed differentiates 59 factor classes and 110 household groups with clear interconnections between the two classifications. This high disaggregation of factor and household accounts aims at providing a good basis for the analysis of distributional effects of trade integration as well as changes in the factor markets.

9. It exhibits transactions with seven trade partners: Israel, Jordan, Turkey, the Greater Arab Free Trade Area (GAFTA), USA, EU-28 and the European Free Trade Area (EFTA) zones, and the rest of the world. This separation builds on the major trade agreements of which Palestine is a member and on the customs union with Israel. The differentiation of Palestine's trade partners allows for a detailed analysis of future trade policy options for the West Bank.

10. This SAM takes proper account of the remuneration of labour for the self-employed, who make about 36% of the total number of workers in the West Bank. Restricting the labour share of value added to the compensation of employees suffers from a major limitation, as it omits the contribution of the self-employed to labour income as discussed in Section 2.3 of Chapter 2. A combination of the Gindling *et al.* (2016) and the Young (1995) approaches is adopted in this thesis to estimate the labour share of value added. First, the self-employed are identified from the labour force survey database and are matched with wage-workers based on socioeconomic characteristics such as the sector of employment, age, gender, and the education level. Then, the wages for the wage-workers are attributed to the self-employed, plus the earning premium estimated by Gindling *et al.* (2016) for the Middle-East region.

11. This SAM also recognises that households derive income from unincorporated capital. Household activity is often disregarded as it usually refers to small-scale, informal and non-market activities (Round, 2003). Household activity includes both family enterprises (which employ family members) and micro enterprises (which hire employees). The income earned by such an activity clearly represents both returns to labour and to capital. The extent to which earlier SAMs have taken proper consideration for household income from unincorporated capital is unclear in most cases. However, this problem is explicitly tackled in constructing this SAM.

12. This SAM is based on the most recent set of data available about the structure of the West Bank economy, consumption and expenditure behaviour of households and the structure of the labour force. The reference year for this SAM is 2011.

The SAM provides data for 59 production factor groups including 57 labour groups, one factor capital and one factor land. The labour factor is well disaggregated in order to capture the participation of the West Bank labour in different labour markets. The domestic labour is first disaggregated by labour market considering that Palestinians are either employed in the domestic market or the Israeli market. In the domestic market, labour is either employed by domestic employers or foreign employers, mainly foreign diplomatic missions residing in the West Bank. Labour employed in the domestic market by domestic employers is further disaggregated by activity and according to their eligibility to obtain a work permit in Israel. This detailed disaggregation allows for the simulation of various degrees of relaxing the restrictions on labour movements between Israel and the West Bank.

Households are extensively disaggregated so as to assess the distributional effects of various policies. The SAM provides data on 110 household groups classified according to consumption quintiles, the skill level of the household members and the labour market which employs them. Tax accounts are also well disaggregated in order to capture the different sources of government revenue. In total, 58 tax accounts are incorporated, among which 45 are factor use taxes, nine are commodity taxes, three are direct taxes, and one is production tax.

East Jerusalem is not included in this SAM, because it is excluded from the main data sources used, which are the national accounts and the balance of payments. Moreover, from a theoretical point of view, the East Jerusalem economy is more connected to the Israeli economy than to the rest of the West Bank. Therefore, it is reasonable to exclude it from a West Bank SAM.

5.3. Constructing the macro-SAM

This section describes the process followed in constructing the macro-SAM. First, it states the sources of data used to generate the unbalanced prior macro-SAM. Then, the technique used to estimate a final balanced macro-SAM is presented.

5.3.1. Data sources for assembling the prior SAM

The information used to compile the prior macro-SAM is derived from different sources, with the Palestinian Central Bureau of Statistics (PCBS) being the main data source. Other data sources include the Palestinian Ministry of Finance, the United Nations Commodity Trade Statistics (UN Comtrade), the International Monetary Fund (IMF) and peer-reviewed papers. PCBS data include the national accounts, the Supply and Use Table, the balance of payments, the labour force survey data, the expenditure and consumption survey data, the economic survey report, the living standards report and the demographics report. Not all these datasets were available for the reference year of 2011. Therefore, some adjustments had to be made to obtain a consistent SAM. The key set of data to which all the other sources are compared to is the West Bank national accounts of 2011.

Table 5.1 summarises the main data sources for each cell of the macro-SAM. The identification of the SAM cells follows the description provided in Table 3.1. A detailed description of the steps followed in assembling the macro-SAM is provided in Appendix 3. The outcome of this process – the prior macro-SAM – is presented in Table 5.2. with all transactions recorded in Million US$.

Table 5.1. Data sources for compiling the unbalanced macro-SAM

Outgoings / Incomings		A Commodity	B Margins	C Activities	D Labour	E Capital	F Land	G House holds	H NPISH	I Enterprise	J Governm ent	K Direct tax	L Indirect tax	M Invest ment	N Foreign account	O Total
1	Commodity		SUT, NA	NA				NA	NA		NA			NA	NA	
2	Margins	SUT, NA														
3	Activities	NA														
4	Labour			LFS, NA, Gi											BoP	
5	Capital			NA											BoP, Ec	
6	Land			PECS												
7	Households				Oc	Oc, Fj	PECS	PECS	PECS	Oc, La	MoF1				BoP	
8	NPISH														Oc	
9	Enterprise					Oc, Fj					MoF2					
10	Government									MoF1		Oc	Oc		BoP	
11	Direct tax				MoF2			PECS		Ec						
12	Indirect tax	MoF2, NA		NA, MoF2												
13	Investment					ER, NA		NA, IMF		NA, IMF, La	NA, IMF				Oc	
14	Foreign account	NA		NA	NA	NA	NA	NA								
15	Total															

Sources: SUT – Supply and Use Table (PCBS, 2014a); NA – National Accounts (PCBS, 2014b); LFS – Labour Force Survey (PCBS, 2012a); Gi – Gindling et al., (2016), BoP – Balance of Payments (PCBS, 2016b); Ec – Establishment census (PCBS, 2012b); PECS - Palestinian Expenditure and Consumption Survey (PCBS, 2014c); Oc – Own calculations (row/column summation); Fj - Fjeldstad and al-Zagha (2004); La - Larudee (2012); MoF1 - Ministry of Finance (MoF, 2012a); MoF2 - Ministry of Finance (MoF, 2012b); ER – Economic Report (PCBS, 2012c); IMF (IMF, 2014).

Table 5.2. Unbalanced prior macro-SAM for 2011 (in Million US$)

	Outgoings / Incomings	A Commodity	B Margins	C Activities	D Labour	E Capital	F Land	G House holds	H NPISH	I Enterprise	J Governm ent	K Direct tax	L Indirect tax	M Invest ment	N Foreign account	O Total
1	Commodity		2055.4	4543.9				7459.8	188.5		1852.4			1754.3	1649.4	19503.7
2	Margins	2055.4														2055.4
3	Activities	10907.6														10907.6
4	Labour			3868.2											671.2	4539.4
5	Capital			2454.8											72.5	2527.3
6	Land			0.7												0.7
7	Households				4530.4	1533.3	0.7	60.2	7.4	250.4	570.6				423.4	7376.5
8	NPISH														195.9	195.9
9	Enterprise					484.2					0.1					484.3
10	Government									44.7		69.6	1673.3		457.6	2245.1
11	Direct tax				8.1			7.1		54.3						69.6
12	Indirect tax	1633.3		40.0												1673.3
13	Investment					446.5		-197.2		134.9	-183.2				2000.3	2201.1
14	Foreign account	4987.0	0.0	0.0	0.9	63.3	0.0	419.1								5470.3
15	Total	19583.3	2055.4	10907.6	4539.4	2527.3	0.7	7749.0	195.9	484.3	2239.8	69.6	1673.3	1754.3	5470.3	

Source: Own compilation.

5.3.2. Estimation of a balanced macro-SAM

A cross entropy program is used to estimate a balanced macro-SAM from the prior macro-SAM of Table 5.2. The cross entropy program is a technique to estimate a SAM, assuming that the initial data are measured with error (Robinson and McDonald, 2006). The estimation philosophy is Bayesian and interactive. This approach treats every cell in the SAM as being specified with an error support set whose weights are estimated. There is a prior, which is specified for each error distribution. Additionally, fixed constraints are achieved by setting standard errors to zero. The cross entropy program used in this thesis was developed by Robinson and McDonald (2006).

For the estimation process, constraints are imposed on the prior macro-SAM such that row sums and corresponding column sums must equal. Additionally, relevant macro totals from the 2011 National Accounts (NA) are fixed so that the final SAM reproduces these figures. For the estimation of the 2011 West Bank macro-SAM, fixed totals are GDP, total savings, net current transfers from abroad, transfers from government, NPISH and household consumption, investment demand, intermediate inputs, market output and depreciation. The estimated balanced macro-SAM is shown in Table 5.3.

Table 5.3. Estimated and balanced final macro-SAM (in Million US$)

Incomings \ **Outgoings**		A Commodity	B Margins	C Activities	D Labour	E Capital	F Land	G House holds	H NPISH	I Enterprise	J Government	K Direct tax	L Indirect tax	M Invest ment	N Foreign account	O Total
1	Commodity		2056.3	4543.9				7459.8	188.5		1852.4			1754.3	1650.7	19505.9
2	Margins	2056.3														2056.3
3	Activities	10843.9														10843.9
4	Labour			3868.2											1102.3	4970.5
5	Capital			2391.1											82.3	2473.3
6	Land			0.7												0.7
7	Households				4961.5	1485.5	0.7	60.1	7.4	249.8	562.5				422.5	7750.1
8	NPISH														195.9	195.9
9	Enterprise					483.7					0.1					483.8
10	Government									44.7		6959.2	165779.		459.7	173243.1
11	Direct tax				8.1			7.1		54.3						69.6
12	Indirect tax	1617.8		40.0												1657.8
13	Investment					446.5		-197.2		134.9	-183.2				1553.4	1754.3
14	Foreign account	4987.9			0.9	57.7		420.3								5466.8
15	Total	19505.9	2056.3	10843.9	4970.5	2473.3	0.7	7750.1	195.9	483.8	2231.8	6959.2	165779.5	1754.3	5466.8	

Source: Own compilation.

5.3.3. Differences between the prior and the estimated macro-SAM

A major outcome of the estimation procedure is the increase of labour income from abroad. This result was expected as no constraint was put on that cell during the estimation process. In fact, the prior used for labour income from Israel that is derived from the balance of payment was too small and does not match the evidence collected from other sources. The initial value for labour income from Israel, according to the balance of payments, only makes 15% of the total labour income in the West Bank (cell "7, D"). By contrast, the labour force survey (PCBS, 2012a) shows that the share of the West Bank working population employed in Israel is 14% and the average wage in Israel is 91% higher the average wage in the domestic West Bank market. Therefore, the expecte share of labour income from Israel should be roughly 27% of the total labour income in the West Bank. In the final estimated SAM, this share has increased to 23% that is closer to the expected share. Adopting this new figure alters the net factor income from abroad that deviates from the national accounts value by 71%. However, the effect of this change on the macroeconomic aggregates is minor. The gross national income (GNI) and the gross disposable income (GDI) deviate respectively by 6% and 5%, while the Gross Domestic Product (GDP) and the net current transfers from abroad are unaffected. In fact, for the later two aggregates, their values during the estimation procedure have been fixed to what is found in the national accounts.

Beside the labour income from Israel, other entries also changed, but with no effect on the macro aggregates, which were fixed in the estimation procedure. This is the case for imports and exports, where the new values slightly depart from their initial entries, but the net export remains the same in both the prior and the final SAM. This is also the case for transfers between households, NPISH and the government with the rest of the world, where the gross values changed, but the net remains constant. The same happens for individual components of domestic savings (households, enterprise and government savings), but total savings are kept constant. Finally, a noticeable change took place in government transfers to households and in foreign savings (current account balance). However, these values were either residuals or taken from sources that were not consistent with the national accounts in the first place.

5.4. Constructing the detailed SAM

The detailed SAM developed for the West Bank for the year 2011 has 376 accounts. This section describes the disaggregation of the macro-SAM entries and the processing of the raw data conducted to estimate the detailed SAM.

5.4.1. Selection of accounts and disaggregation criteria

To arrive at the detailed SAM, some of the macro-SAM accounts are further disaggregated. The reason for the disaggregation is to display sufficient detail about the production structure and income distribution in the economy. The following accounts are disaggregated: activity, commodity, margins, labour and households. The West Bank SAM adopts a commodity by industry set-up, such that an activity can produce multiple products. Labour and household classifications are chosen in a way to depict explicitly the interconnections between the two accounts and to address employment and equity issues. In the following lines, the disaggregation criteria and the resulting detailed SAM accounts are presented.

Activity

The disaggregation of activities is mostly based on the West Bank Supply and Use Table (SUT) of 2004 (PCBS, 2014a), which follows the International Standard Industrial Classification (ISIC Rev. 3). The SUT provides for 55 activity accounts of which two are zero accounts. Among the remaining 53, there are five financial accounts, with one reserved for imputed banking charges. The later account has no production but uses intermediate inputs. For convenience, and due to the focus on the real economy, all five financial accounts were merged into one. Similarly, the sewage account has no production but uses some intermediate inputs. Therefore, it was merged with the activity water and electricity production, which is the only activity producing a sewage commodity in the SUT. As a result, the SAM has 48 sectors, of which 4 are agricultural sectors, 2 are mining sectors, 20 are manufacturing sectors, and 22 are service sectors. In addition to these sectors, one activity is introduced for the NPISHs. It is noteworthy that the SAM does not make an explicit link between the NPISHs as institution and the activity “NPISH”. Subsequently, the user should model the link explicitly when running simulations on NPISH.

Commodity

The disaggregation of commodities is also based on the West Bank SUT of 2004 (PCBS, 2014a). The SUT provides for 97 commodity accounts, out of which ten are zero accounts. Among the remaining 87, the four financial accounts are grouped into one and the sewage account is merged with the water account for the reasons mentioned above. As a result of this process, there are 83 commodity groups in the SAM with the possibility for each commodity to be produced by more than one activity. The SAM differentiates between 8 agricultural products, 2 mining products, 40 manufacturing products and 33 services.

Margins

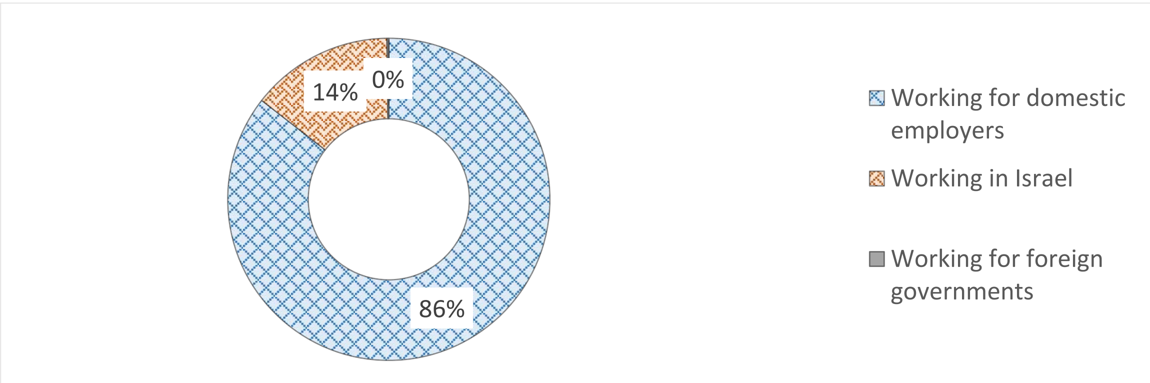
The disaggregation of margins is also derived from the West Bank SUT of 2004, which provides for three types of margins: wholesale, retail sale and transport margins.

Factors

The SAM includes 59 factor groups among which 57 are labour-groups, one is the factor capital and one is the factor land. Labour is disaggregtaed in order to capture the participation of the Palestinian labour force in different labour markets. First total labour in the West Bank is split between foreign and Palestinian domestic labour. The domestic labour is further differentiated by labour markets to differentiate between the labour commuting to Israel for work, labour working inside the West Bank for domestic employers, and labour employed by foreign diplomatic missions residing in the West Bank.

The internal domestic market employs most of the workforce, while the Israeli market also employs a significant share (Figure 5-1). The labour groups are further disaggregated by skill level distinguishing between low and high-skilled workers based on the number of years of education with the cutting edge set at 12 years of formal education. Workers with higher education (more than 12 years of schooling) are considered as high-skilled. This classification is consistent with the International Standard Classification of Occupations (ISCO-08), which has four skill levels with the highest two reserved for workers who visited a higher educational institution (ILO, 2012). Following this criterion, 71% of the working population are low-skilled and 29% are high-skilled (PCBS, 2014d).

Figure 5-1. Distribution of West Bank working population by labour market



Source: PCBS, 2014d.

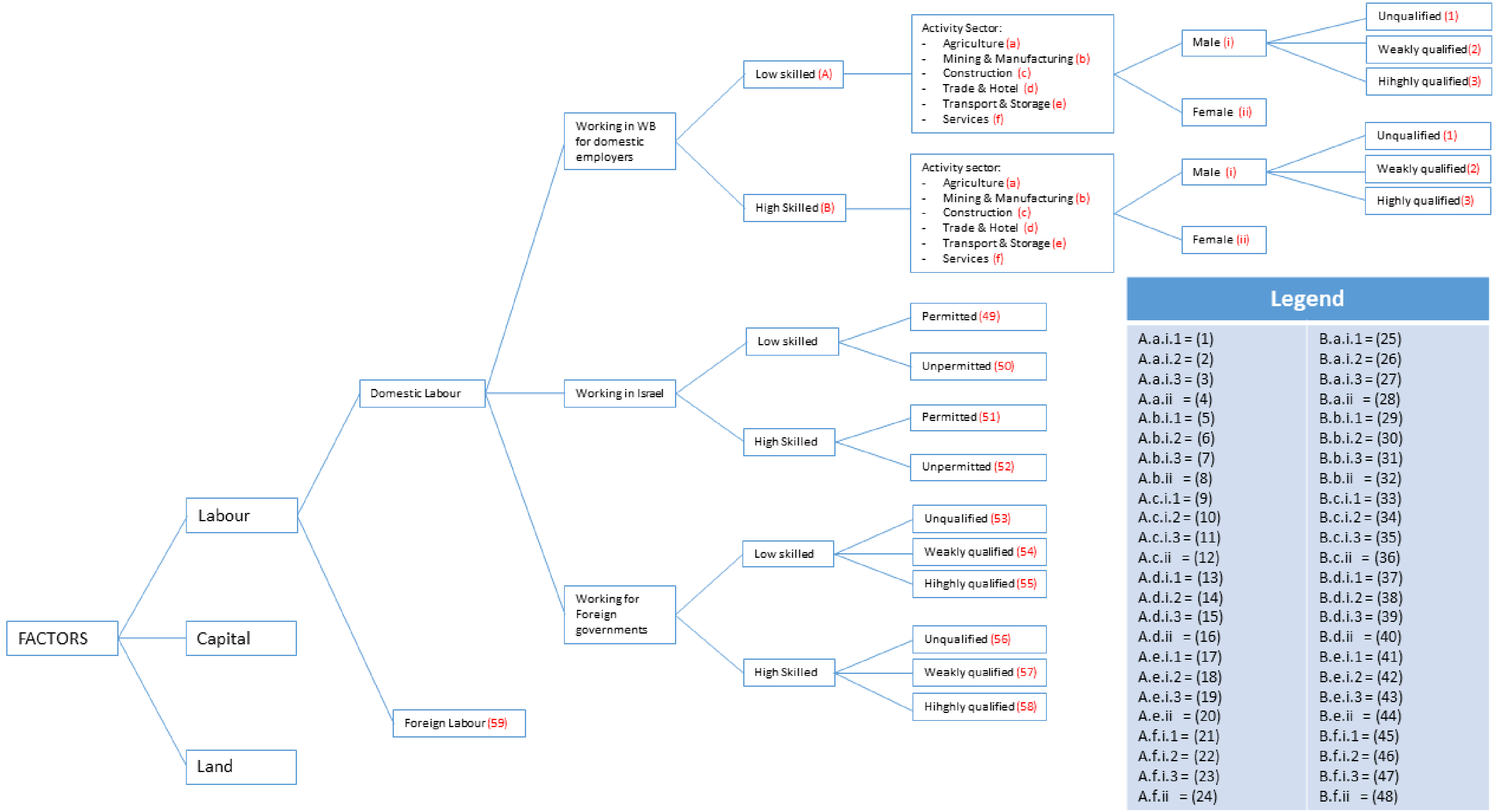
Domestic labour groups employed in the domestic market are disaggregated by employment sectors. Six employment sectors are considered in the 2011 Labour Force Survey data (LFS) (PCBS, 2014d), namely: agriculture, manufacturing, construction, commerce and hotels, transport, and services. Moreover, the labour in the domestic market is further differentiated by gender and eligibility for a work permit in Israel. According to the 2011 LFS, 25% of the working population employed in the domestic market is composed of females, while 75% are males (PCBS, 2014d). Only male workers are further classified according to the eligibility for a work permit in Israel as the share of female workers employed in Israel is negligible (1%) (PCBS, 2012a).

Permits for working in Israel are granted to Palestinians based on personal and civil status criteria presumably associated with a lower likelihood for them to be involved in attacks against Israelis. These criteria differ over time according to the intensity of the conflict between the two regions. At the height of the second Palestinian uprising (2000-2004), the main requirements were to be married with children, and be above the age of 34 years (Etkes, 2012). West Bank workers meeting these high requirements are classified as highly eligible (or qualified) for a work permit. In a period of low conflict like in 2014, the main criteria were to be married, and be above the age of 23 years (COGAT, 2014). West Bank workers only fulfilling these criteria are categorised as weakly eligible for a work permit. The remaining workers are classified as ineligible (or unqualified). Based on these criteria, 53% of the West Bank labour employed in the domestic market are ineligible, 15% only meet the weak eligibility requirements and 32% are highly eligible (PCBS, 2014d).

West Bank workers employed in Israel are classified according to their permit situation. Among them, 62% work with a permit, while 38% do not have any work permit (PCBS, 2016a). The domestic labour employed by foreign diplomatic missions residing in the West Bank is also differentiated according to the eligibility for a work permit in Israel. This criterion is relevant when it comes to simulating the switch of employment to Israel in case the mobility of Palestinian labour to Israel is eased. Based on this criterion, 55% of the working population employed by foreign diplomatic missions residing in the West Bank are ineligible for a work permit in Israel, 14% meet the weak eligibility requirements and 31% meet the high requirements (PCBS, 2014d).

Figure 5-2 illustrates the disaggregation of factor accounts.

Figure 5-2. Disaggregation of factor accounts



Source: Own illustration.

Household groups

Household data are derived from the Palestinian Expenditure and Consumption Survey (PECS) of 2011 (PCBS, 2014c). Households in the SAM are disaggregated in order to incorporate sufficient details allowing for policy analysis that addresses income distribution and household livelihoods. In this SAM, households in the West Bank are first disaggregated into expenditure quintiles for the purpose of cross-sectional comparisons. The quintiles are defined based on consumption expenditure per adult equivalent. Consumption expenditure is used instead of income, as income in developing regions like the West Bank is often underreported. By contrast, consumption expenditure, which includes both goods and services that are purchased, and those that are produced for the home consumption, shows current standards of living and reflects better the long-term average well-being (Haughton and Khandker, 2009). The equivalence scale is used for grouping households. Using such an equivalence scale captures the economies of scale that arise from sharing some living conditions such as the housing space. The consumption per adult equivalent used is based on the square root scale (OECD, 2012). This equivalence scale divides household consumption by the square root of household size.

The second differentiation level is by the average skill level of the economically active household members. This criterion is introduced in order to have a good mapping between the labour classes and household groups. Household members who are at least age 15 (minimum age to enter the active population) are selected and their average number of years of schooling is calculated. When this average at household level is lower than 12 years, the household is considered as "low-skilled" household; otherwise, it is considered as "high-skilled" household. Low-skilled households are more represented in the poorer quintiles than in the richer ones (Table 5.4).

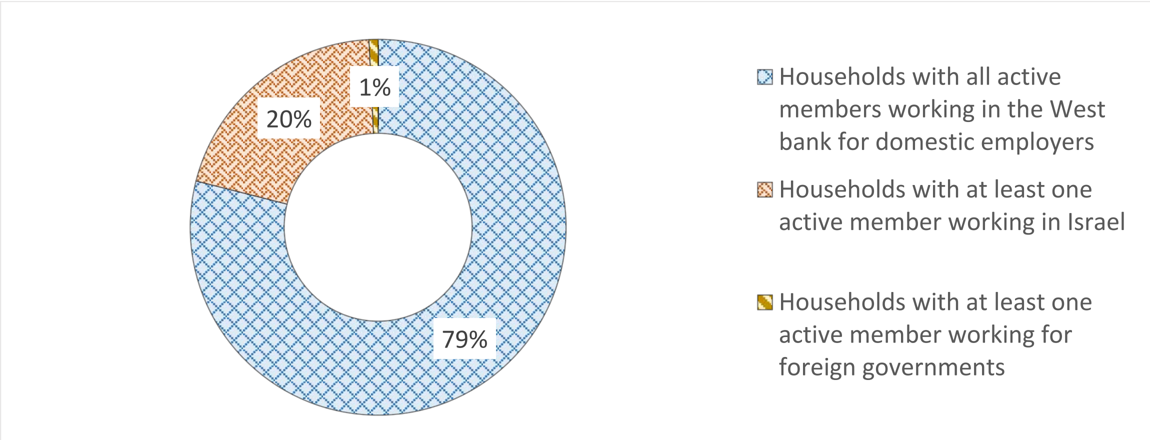
Table 5.4. Distribution of West Bank households by consumption quintiles and skill

	Low-skilled households		High-skilled households		Total	
	Number of households	Share	Number of households	Share	Number of households	Share
Quintile 1	484	20%	45	2%	529	22%
Quintile 2	440	19%	91	4%	531	23%
Quintile 3	384	16%	104	4%	488	20%
Quintile 4	333	14%	134	6%	467	20%
Quintile 5	204	9%	154	6%	358	15%
Total	1,846	78%	527	22%	2,373	100%

Source: PCBS, 2014c.

The third disaggregation level is the labour market employing the economically active household members. Similar to the classification adopted for the factor labour, three labour markets are considered: households with all members working in the West Bank for domestic employers, households with at least one member working in Israel and households with at least one member working for foreign diplomatic missions residing in the West Bank. As depicted in Figure 5-3, about 20% of households have at least one member employed in the Israeli labour market.

Figure 5-3. Distribution of households by the labour market of their active members



Source: PCBS, 2014c.

Finally, households are further disaggregated based on the eligibility of their economically active members to a work permit in Israel. Likewise, for labour classification, three qualification statuses are considered: ineligible, weakly eligible and highly eligible workers. At household level, there are nine possibilities of household composition based on the eligibility of the economically active household members. However, the combinations with less than 1% of the total are merged with others, to come to 4 consistent combinations (Table 5.5).

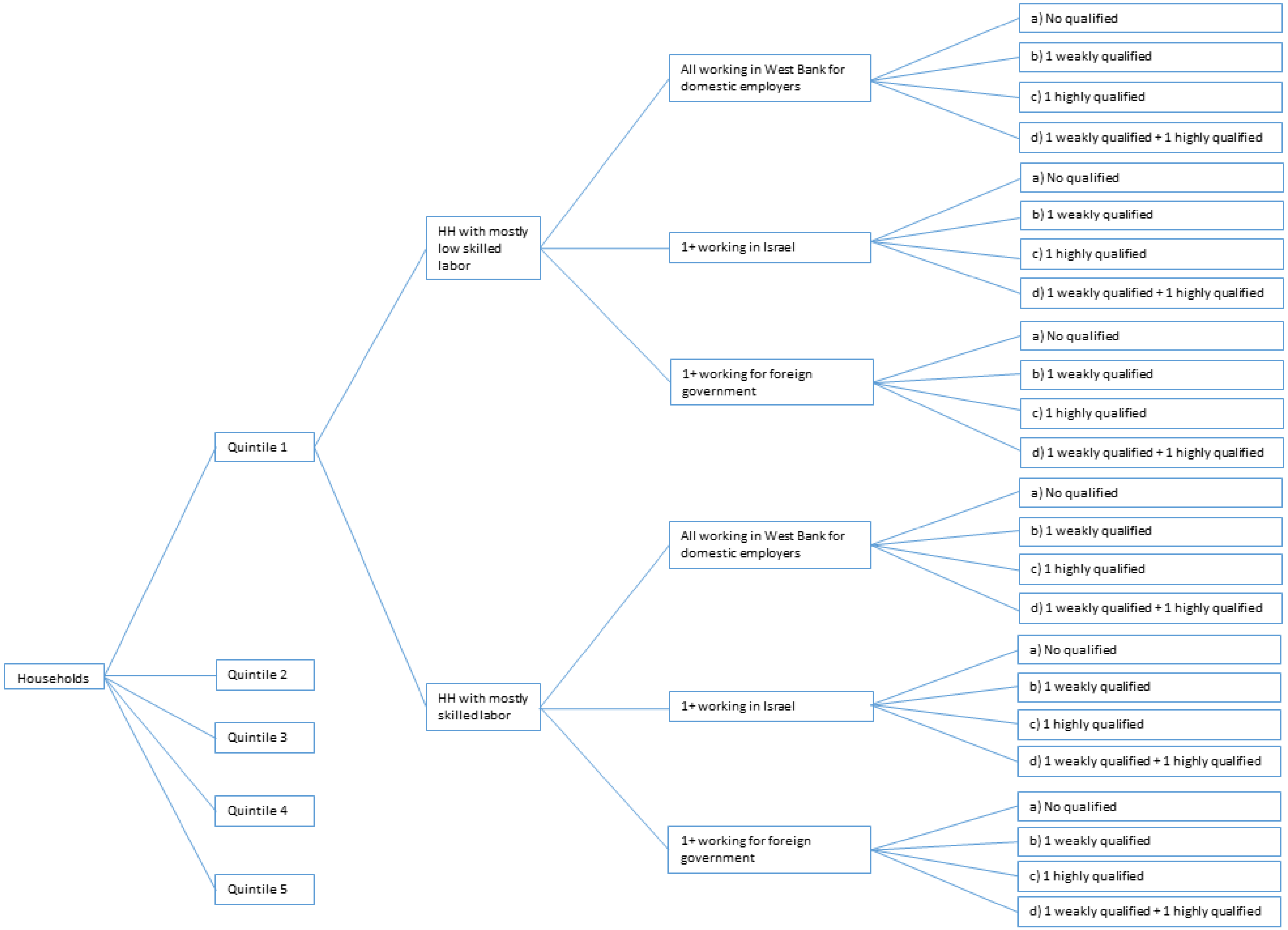
Table 5.5. Household classes according to number of eligible members

Initial combinations		Final combinations	
Description	Percent	Description	Percent
No eligible member	19.77%	No eligible member	19.77%
One weakly eligible member	18.85%	At least one weakly eligible member	19.29%
Two weakly eligible members	0.44%		
One highly eligible member	56.35%	At least one highly eligible member	56.70%
Two highly eligible members	0.35%		
One weakly and one highly eligible members	3.43%	At least one weakly and one highly eligible members	4.24%
Two weakly and one highly eligible members	0.74%		
One weakly and two highly eligible members	0.05%		
Two weakly and two highly eligible members	0.02%		
Total	100%		100%

Source: PCBS, 2014c.

The stratified classification of households provides for 120 households (Figure 5-4). Out of these 120 groups, 20 are empty and the final SAM actually comprises 110 household groups.

Figure 5-4. Disaggregation of household accounts



Source: Own illustration.

5.4.2. Processing of the raw data to assemble the prior detailed SAM

The breakdown of the macro-SAM cells to arrive at the detailed SAM involves the processing of different sets of raw data. The initial values entered for the detailed SAM are derived from the Supply and Use Table of 2004 (PCBS, 2014a), the national accounts for 2011 (PCBS, 2014b), the Palestinian expenditure and consumption survey (PCBS, 2014c), the UN Comtrade database (UN Contrade, 2015) and the Palestinian Labour Force Survey (PCBS, 2014d). Supplementary information from other sources, including the WTO tariff book (WTO, 2016), the Balance of Payments (PCBS, 2016b), the Ministry of finance reports (MoF, 2012a, 2012b), the land use statistics (PCBS, 2016c), the inbound visitors survey (PCBS, 2009), the hotel activity survey of 2011 (PCBS, 2012d), and the foreign investment statistics in Palestine (PCBS, 2016d) is used. The detailed description of the process of imputing the initial values for the detailed SAM is provided in Appendix 3.

5.4.3. Estimation of a balanced detailed SAM

To come to a final balanced SAM, the total of each submatrix is first scaled up to the value of the corresponding entry in the macro-SAM. Thus, the detailed SAM was made consistent with the macro-SAM. However, individual SAM accounts presented discrepancies. Therefore, the challenge was to remove these discrepancies in the individual SAM accounts, while keeping the consistency with the macro-SAM. To achieve this goal, the SAM is estimated using the cross entropy program developed by Robinson and McDonald (2006).

In the estimation process, macro totals such as GDP are fixed with zero standard error. Additionally, the macro-SAM totals are used as controls with zero standard errors. Individual SAM elements and account totals are also specified as controls so as to arrive at a final estimated SAM consistent with the macro-SAM, balanced in every single SAM account and overall consistent with the 2011 NA (PCBS, 2014b).

After the estimation with the cross-entropy program, a second round of estimation was conducted to remove the imputed banking charges, which were present in the SAM as negative capital compensation in the finance sector. As most CGE models require the values of all factor usage to be positive, these imputed banking charges were removed following a procedure described in the problem area of the GTAP Database contributor's website[7].

[7] https://www.gtap.agecon.purdue.edu/databases/contribute/bankingsect.asp. This procedure has been fully automatized in GAMS and the code can be shared with interested researchers.

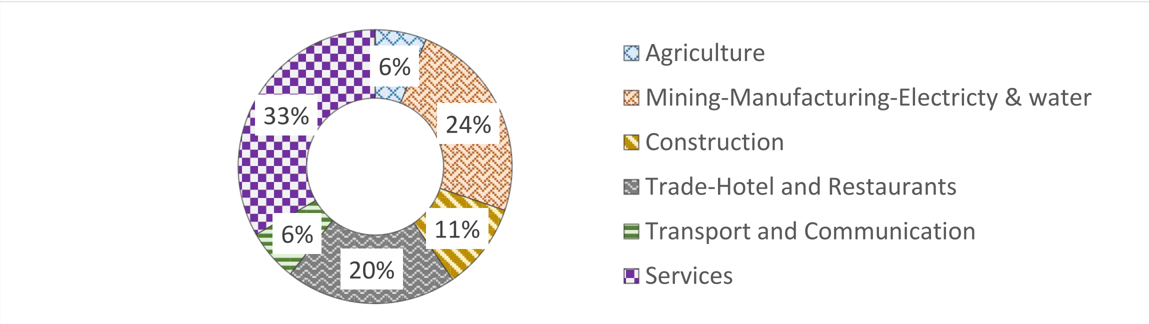
5.5. Structure of the West Bank economy: observations from the SAM

This section presents some characteristics of the West Bank economy in light of the constructed SAM. First, the structure of domestic production is shown, followed by the composition of the production factors. Next, household income sources are investigated as well as their expenditure patterns. Finally, the trade pattern of the West Bank is documented.

5.5.1. Structure of domestic production: output and input demand

Services are the dominant sector in the West Bank economy contributing to 33% of the total market output value. Agricultural production represents 6% of the total market output (Figure 5-5). In the agricultural sector, crop production forms 59% of the agricultural market output value, while animal production forms the remaining 41%.

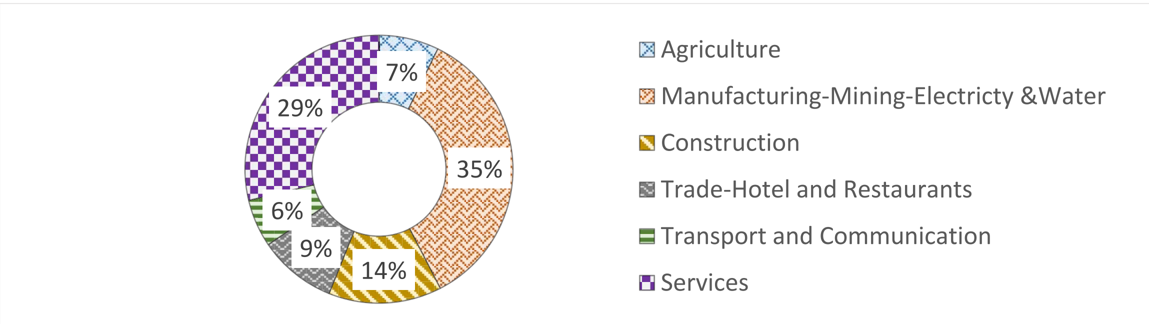
Figure 5-5. Domestic production by aggregated activity



Source: West Bank SAM.

The manufacturing sector is the most intermediate input demanding sector in the West Bank economy (Figure 5-6). The agricultural sector accounts for 7% of total input demand, with crop production representing 52% of the agricultural sector input demand, against 48% for animal production.

Figure 5-6. Intermediate input demand shares by aggregated activity sector

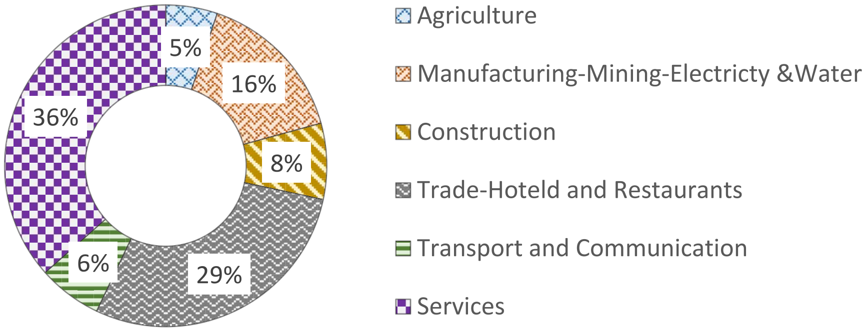


Source: West Bank SAM.

5.5.2. Value added and production factors

The service sector accounts for 36% of total value added, while the agricultural sector accounts only for 5% (Figure 5-7).

Figure 5-7. Value added shares by aggregated activity sector



Source: West Bank SAM.

Labour accounts for 62% of the total value added, net of depreciation and of production taxes. Capital makes up 38% of the net value added, while the share of land is negligible. A deeper look at the distribution of value added across activities shows that services contribute to 41% of the total labour compensation, while trade contributes the most to the remuneration of capital (Table 5.6).

Table 5.6. Distribution of value added by activity

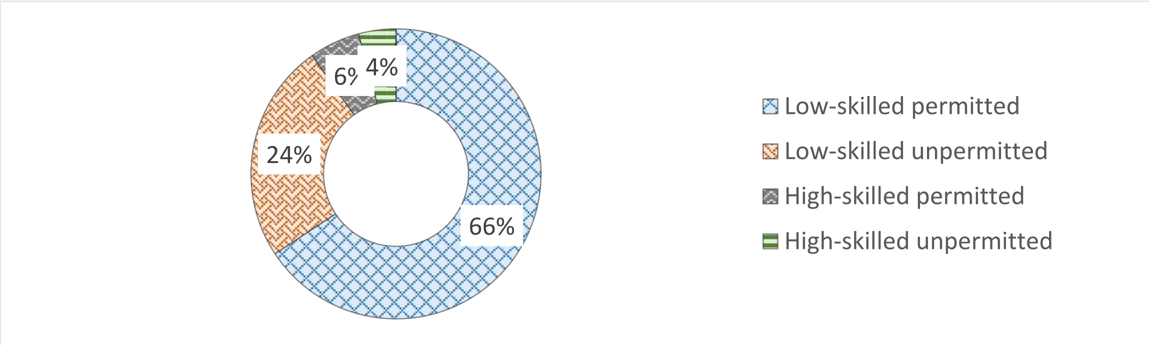
	Agri-culture	Manu-facturing	Construc tion	Trade-Hotel and Restaurants	Transport and Communication	Services	Total
Low-skilled males	7%	18%	17%	32%	10%	16%	100%
Low-skilled females	48%	15%	0%	11%	0%	26%	100%
High-skilled males	2%	7%	5%	16%	4%	65%	100%
High-skilled females	2%	3%	0%	4%	1%	90%	100%
All labour	7%	12%	10%	22%	7%	41%	100%
All Capital	2%	21%	3%	39%	6%	30%	100%

Source: West Bank SAM.

A unique feature of the West Bank labour force is its participation in different labour markets. In addition to the domestic labour market, about 14% of the labour force is employed in Israel and 0.2% is employed by foreign diplomatic missions residing in the

West Bank (PCBS, 2014d). As a result, 23% of the total West Bank labour income stems from Israel and 0.2% from foreign diplomatic missions residing in the West Bank. The compensation of employees received from Israel accrues mostly to low-skilled labour, with permitted workers accounting for more than two thirds of the total (Figure 5-8).

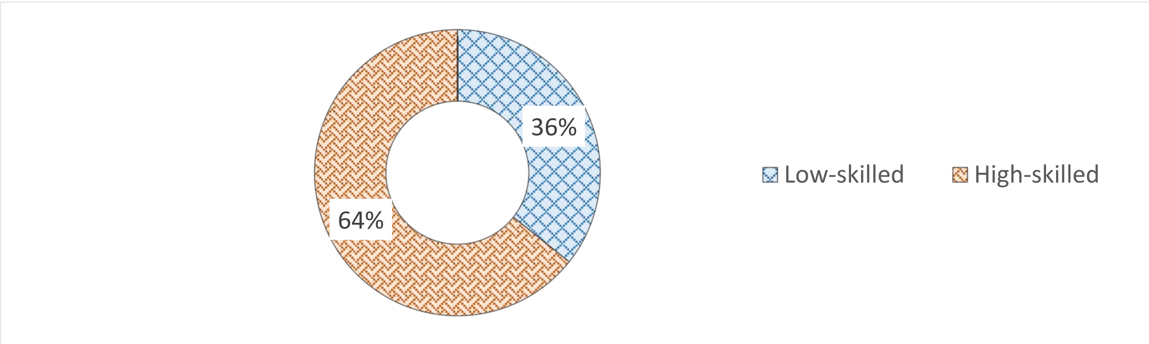
Figure 5-8. Share of compensation of employees received from Israel by labour group



Source: West Bank SAM.

In contrast to the labour compensation received from Israel, where the low-skilled labour makes up the lion's share, high-skilled labour accounts for the largest share in the compensation of labour employees received from the other six foreign regions (Figure 5-9).

Figure 5-9. Share of compensation of employees received from the rest of the world



Source: West Bank SAM.

5.5.3. Household income and expenditure

Households in the West Bank derive most of their income from labour (Table 5.7). Capital is an important source of income, accounting for 22% of total household income. A substantial part of that capital income stems from unincorporated capital and can be put into perspective with the substantial proportion (36%) of the West Bank working population that is self-employed (PCBS, 2014d). The land rent is negligible. Transfers from the NPISH are a higher share in the income of the poorer quintiles. By contrast, remittances are a higher share in the income received by the richest quintile. Transfers from the government makes 7% of the total household income and their shares are high in incomes of both the top and the lowest quintiles.

Table 5.7. Shares of household income by income source and household quintile

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	All households
Labour	77.66%	77.05%	74.78%	63.50%	47.82%	63.99%
Total capital	7.16%	11.22%	15.73%	25.62%	33.84%	22.38%
Land	0.00%	0.00%	0.01%	0.01%	0.02%	0.01%
Inter-household transfers	1.28%	0.78%	0.78%	0.67%	0.68%	0.78%
NPISH transfers	0.30%	0.18%	0.05%	0.07%	0.03%	0.10%
Government transfers	10.26%	7.57%	4.30%	6.36%	8.40%	7.25%
Remittances	3.26%	3.19%	4.34%	3.78%	9.22%	5.50%
Total	100%	100%	100%	100%	100%	100%

Source: West Bank SAM.

The distribution of household income from labour shows that the richer the household, the less income it derives from low-skilled labour and the more income it earns from high-skilled labour employed in the domestic market (Table 5.8). All household quintiles have members employed in Israel and by foreign diplomatic missions residing in the West Bank. However, the share of labour income from Israel is higher in the lower quintiles than in the top one. The share of labour income from oreign diplomatic missions residing in the West Bank is small for all the household quintiles.

Table 5.8. Distribution of labour income to households by labour and household group

Labour groups		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	All households
Working for domestic employers	Low-skilled	64.20%	56.33%	47.58%	38.41%	29.97%	44.88%
	High-skilled	14.77%	22.32%	29.61%	35.50%	51.53%	33.07%
Working in Israel	Low-skilled	19.58%	19.69%	21.22%	22.64%	15.66%	19.72%
	High-skilled	1.23%	1.45%	1.43%	3.30%	2.70%	2.16%
Working for foreign diplomatic missions	Low-skilled	0.10%	0.07%	0.06%	0.06%	0.03%	0.06%
	High-skilled	0.12%	0.14%	0.10%	0.09%	0.11%	0.11%
Total		100%	100%	100%	100%	100%	100%

Source: West Bank SAM.

Investigating the share of total capital accruing to each household group informs that about half of the capital income accrues to the richest quintile (Table 5.9). The poorest quintile mostly derives capital income from unincorporated businesses. This result confirms that poor households usually do not own stocks and shares in incorporated businesses.

Table 5.9. Distribution of capital income among household quintiles

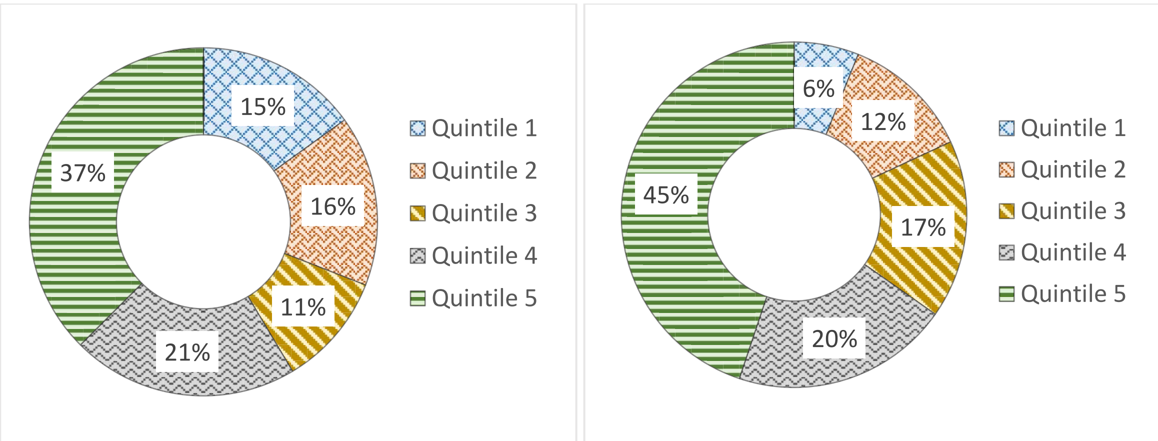
	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total capital	3.44%	7.62%	12.47%	27.50%	48.97%	100%
Unincorporated capital	3.98%	8.81%	13.86%	26.70%	46.65%	100%
Incorporated capital	0.23%	0.56%	4.19%	32.24%	62.78%	100%

Source: West Bank SAM.

More than half of government transfers go to the top two quintiles (Figure 5-10a). This result, put into perspective with the household income from labour (see Table 5.8), reflects the fact that large share of the government transfers is actually made of pension payments. As the richer households have a higher proportion of high-skilled workers employed in the domestic market, mostly working in the public sector, they receive large transfers from the government. All household groups receive remittances from the rest of the world. The top quintile receives almost half of all remittances, while the lowest quintile only receives 6% (Figure 5-10b).

Figure 5-10. Share of income received by household group and income source

a. Government transfers b. Remittances



Source: West Bank SAM.

On the household expenditure side (Table 5.10), the main expenditure line is household consumption with on average 96% of total household expenditures. All households have negative savings, but the de-saving rate is higher for the richer households. Gross inter-household transfers make up on average about 1% of household total expenditure, with the richest quintile having the highest share. The top quintiles make more transfers to abroad than the poorer ones. Direct tax rates on households are on average very low (0.1%).

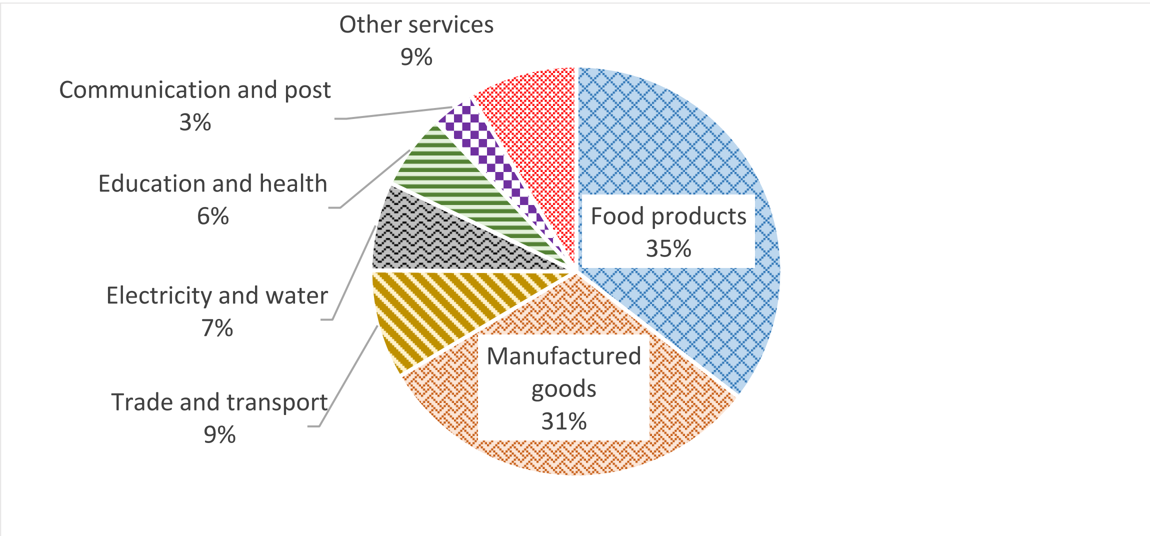
Table 5.10. Household expenditure shares

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	All households
Consumption	97.3%	97.2%	96.8%	96.8%	94.6%	96.2%
Gross inter-household transfers	0.1%	0.2%	0.4%	0.7%	1.5%	0.8%
Transfers to abroad	3.0%	3.5%	4.2%	4.9%	8.3%	5.5%
Direct tax	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Savings	-0.5%	-1.0%	-1.6%	-2.5%	-4.5%	-2.5%
Total	100%	100%	100%	100%	100%	100%

Source: West Bank SAM.

A deeper look at the consumption of different commodities shows that households spend about a third of their consumption budget on food products and another third on manufactured goods and services (Figure 5-11).

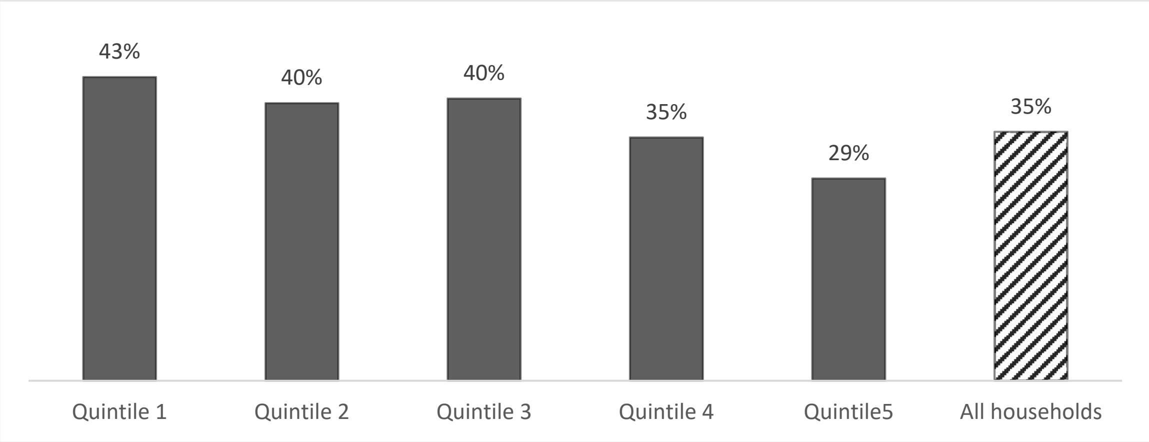
Figure 5-11. Household consumption expenditure by aggregated commodity group



Source: West Bank SAM.

Households in the poorest quintile have the highest share of food expenditure, while the richest quintile has the lowest share (Figure 5-12).

Figure 5-12. Household food expenditure share in consumption expenditure

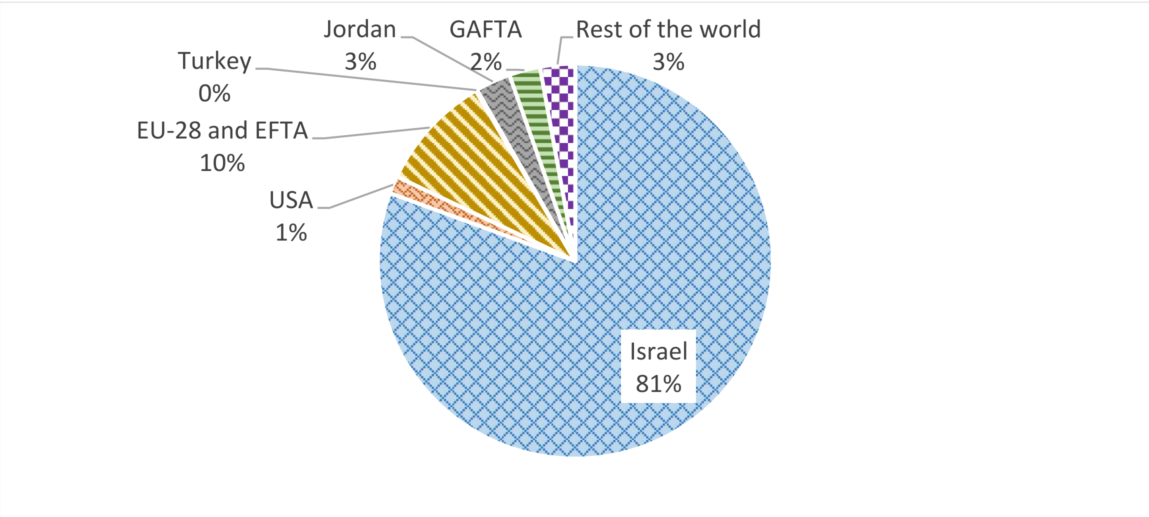


Source: West Bank SAM.

5.5.4. Transactions with foreign accounts

Seven foreign accounts are included in the SAM: Israel, USA, EU-28 and EFTA, Turkey, Jordan, GAFTA, and rest of the world. Among them, Israel is the main trade partner for the West Bank. Regarding exports, Israel accounts for 81% of West Bank total exports (Figure 5-13).

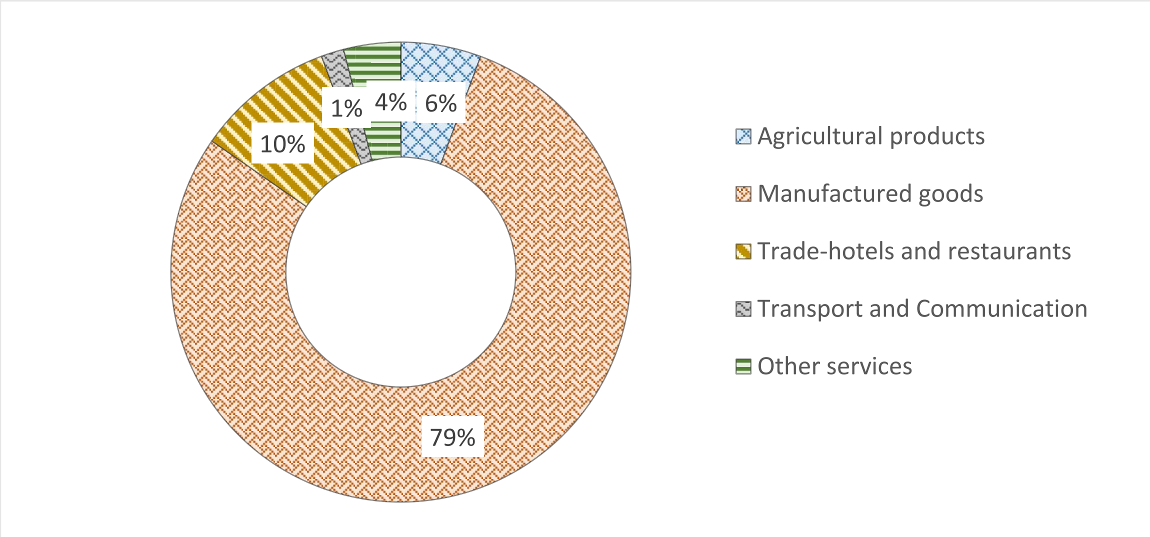
Figure 5-13. Shares of West Bank exports by destination



Source: West Bank SAM.

Most of West Bank exports are manufactured goods (Figure 5-14). The total export constitutes about 15% of the domestic production.

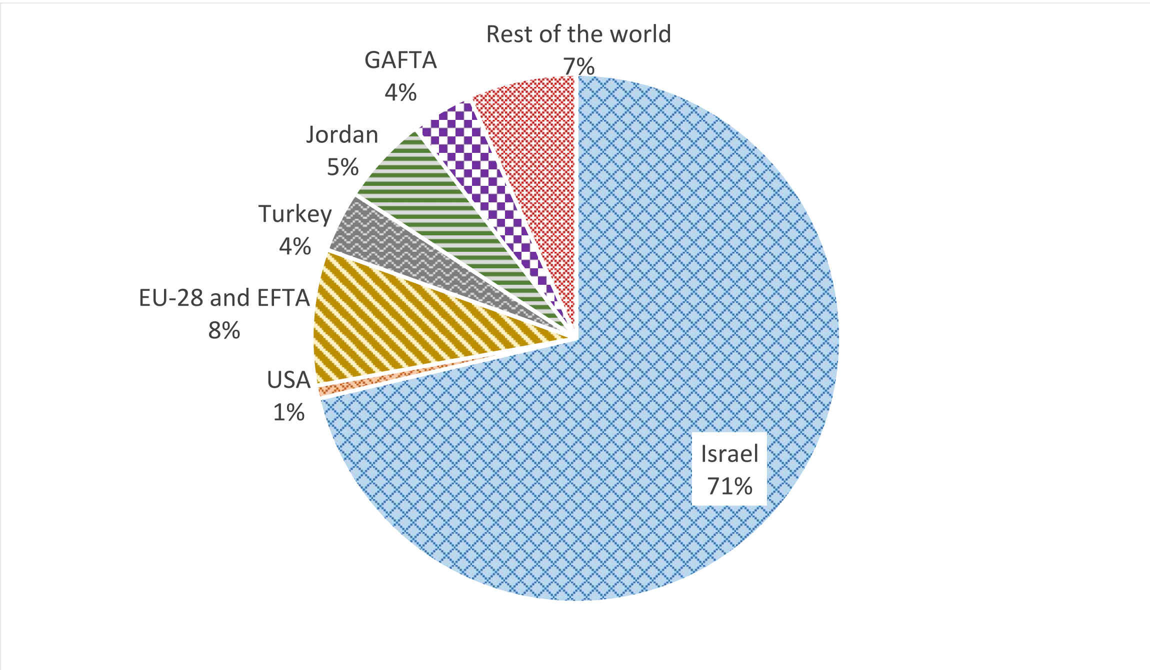
Figure 5-14. Shares of West Bank exports by commodity group



Source: West Bank SAM.

Imports make up 32% of the total absorption of goods and services in the West Bank. From the import perspective, Israel is the main trade partner with 71% of West Bank total import (Figure 5-15).

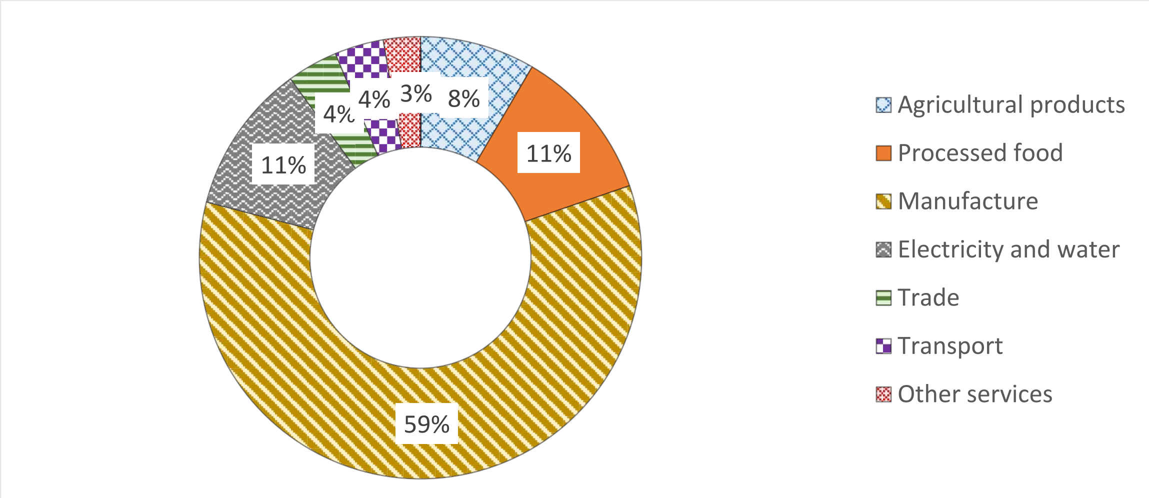
Figure 5-15. Shares of West Bank imports by commodity group



Source: West Bank SAM.

Manufactured goods compose most of the imports of the West Bank (Figure 5-16).

Figure 5-16. Shares of West Bank imports by commodity group



Source: West Bank SAM.

5.6. Conclusion and potential for data improvement

The 2011 SAM for the West Bank has been developed based on data gathered from different sources, including institutions inside Palestine such as the PCBS and the Palestinian Ministry of Finance as well as institutions outside Palestine like the IMF, the World Bank and institutions coordinating Israeli activities in the Palestinian territories. These official sources are also complemented with estimates derived from peer-reviewed journals.

The national accounts of the West Bank for the year 2011 is the reference data set to which the other sources are compared and – when feasible – adjusted. Despite these adjustments, the data taken from different sources are not always converging and this resulted in discrepancies that are removed during the estimation of both the macro and detailed SAMs using the cross-entropy program. In that process, some parameters are fixed and others are estimated by the program. Therefore, there are some entries of the SAM that are more reliable than others. Table 5.11 presents the data reliability matrix[8] that shows the quality of the data based on the sources and the procedures followed to compile the macro-SAM, while Table 5.12 shows the data reliability matrix for the detailed SAM based on the procedures to build each submatrix of the detailed SAM. A grading scheme is adopted for each matrix to illustrate the reliability level of each cell or submatrix. For the data reliability matrix of the macro-SAM, the grading scheme is as follows:

[8] The data reliability matrix does not build on any international consensus on data quality. Readers can assess the data quality based on their own standards by reading the description of each grade.

- Grade A: data of best reliability. This includes entries that are exclusively based on the national accounts for the West Bank for the year 2011.

- Grade B: data of second best reliability. This includes entries in the macro-SAM whose values stem from the PCBS data sets other than the national accounts. This comprises the balance of payments and the Ministry of finance statement that were initially available for the whole Palestine, from which the share of the West Bank is derived based on other official statistics. It also includes data taken from the Supply and Use Table of 2004 that were extrapolated to 2011, and data from official surveys such as the labour force survey and the Palestinian expenditure and consumption survey that were scaled up to the entire West Bank population.

- Grade C: this grade is attributed to entries in the macro-SAM that involved external data, assumptions and expert judgment.

For the data reliability matrix of the detailed SAM, the grading scheme is as follows:

- Grade 0: this grade is attributed to entries in the detailed SAM that did not involve any disaggregation, i.e. their values in the macro and detailed SAMs are identical.

- Grade A: data of best reliability. This includes the submatrices for which disaggregation is entirely based on the PCBS Supply and Use Table for the West Bank in 2004.

- Grade B: data of second best reliability. This includes submatrices whose disaggregation is based on PCBS surveys such as the expenditure and consumption survey or the labour force survey. For most of these submatrices, a mapping between their initial classification and the SAM classification was required.

- Grade C: this grade is attributed to submatrices whose disaggregation has involved external data, assumptions and expert judgment.

In the data reliability matrix for the macro-SAM, two of the entries with a grade C are related to the mixed income of self-employed. The first is the labour share in value added, including the self-employed, and the second is household income from unincorporated capital. The estimation of these parameters has been overlooked in the existing SAM literature. These issues are addressed with a specific methodology, which has been shown in Section 5.2 of this chapter. However, this methodology can be improved, especially if the data availability constraints are overcome. Data quality for cells with grade B that were generated from data initially aggregated at national level could also be improved if the corresponding data for the West Bank were readily available.

In the data reliability matrix for the detailed SAM, most of the cells with a grade C refer to the foreign accounts. In fact, collecting detailed information on transactions between the West Bank and individual trade partner, especially for trade in services, was constrained by the lack of such detailed data. Therefore, data quality could be improved if more detailed data are availed. The quality of entries with grade B in the detailed SAM could also be improved as these submatrices are disaggregated based on the Supply and Use Table of 2004. Subsequently, they can be updated whenever a more recent Supply and Use Table is available.

Table 5.11. Data reliability matrix for the macro-SAM

Incomings \ Outgoings		A Commodity	B Margins	C Activities	D Labour	E Capital	F Land	G House holds	H NPISH	I Enterprise	J Governm ent	K Direct tax	L Indirect tax	M Invest ment	N Foreign account	O Total
1	Commodity		B	A				A	A		A			A	A	
2	Margins	B														
3	Activities	A														
4	Labour			C											B	
5	Capital			B											B	
6	Land			B												
7	Households				B	C	B	B	B	C	B				B	
8	NPISH														C	
9	Enterprise					C					B					
10	Government									B		B	B		B	
11	Direct tax				B			B		B						
12	Indirect tax	B		B												
13	Investment					B		C		C	C				C	
14	Foreign account	A			B	B		B								
15	Total															

Source: Own compilation.

Table 5.12. Data reliability matrix for the detailed SAM

	Outgoings	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Incomings	Commodity	Margins	Activities	Labour	Capital	Land	House holds	NPISH	Enterprise	Governm ent	Direct tax	Indirect tax	Invest ment	Foreign account	Tot al
1	Commodity		A	A				B	A		A			A	C	
2	Margins	A														
3	Activities	A														
4	Labour			B											C	
5	Capital			A											C	
6	Land			B												
7	Households				B	C	B	C	B	B	B				C	
8	NPISH														C	
9	Enterprise					0					0					
10	Government									0		0	0		B	
11	Direct tax				B			B		0						
12	Indirect tax	C		B												
13	Investment					0		B		0	0				C	
14	Foreign account	C			C	C		C								
15	Total															

Source: Own compilation.

6

EMPIRICAL ANALYSIS OF THE IMPLICATIONS OF DIFFERENT LABOUR MARKET CONDITIONS IN CGE MODELS: THE CASE OF THE WEST BANK[9]

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Chapter 6 Empirical analysis of the implications of different labour market conditions in CGE models: the case of the West Bank

6.1. Introduction

The sensitivity of simulation results is a well known challenge to CGE modellers. While there is an extensive literature on the role of macroeconomic closure conditions and the effect of parameter values, especially trade elasticities, little is known about the implications of different factor market clearing conditions (McDonald, 2018). A starting point in the discussion is the definition of a production boundary. The production boundary determines the economic activities that are included in the model and those that are excluded. In price-driven whole economy models, like CGE models, the production and consumption boundaries follow the approach adopted by the System of National Accounts (SNA). Accordingly, production and consumption decisions relating to goods and services take place within the boundary only if those goods and services can have uniquely determined prices. Subsequently, the activities within the production boundary are the ones using inputs and that are controlled and organised by institutions (United Nations, 2009).

Activities producing goods and services for sale on the markets, i.e. the market activities, satisfy the SNA condition that prices can be uniquely defined, whether or not the goods and services that are produced are actually sold (McDonald, 2018). By contrast, the activities undertaken by household members to produce services that are consumed by the household at home, i.e. the non-market activities, are excluded from the SNA definition. Those services do not satisfy the condition that their prices be determined in a unique way, because there are no suitable market prices to value such services. The main input for the production of services by the household for its own use that is excluded from the SNA accounting is “labour”.

The delimitation of a production boundary has important implications for the definition of macroeconomic aggregates and for the welfare analysis. By convention, macroeconomic aggregates such as absorption and GDP are defined with reference to goods and services produced and consumed within the SNA boundary. However, it is evident that households derive utility not only from the consumption of goods and services purchasable from the market, but also from services produced outside the SNA boundary. Hence, for a full accountability of the welfare effects, changes within and outside the boundary need to be reported. This is especially important when there are transfers of labour across the boundary. When a policy shock leads to increases in the wage rates within the production boundary, households allocate more labour to the market activities at the expense of the non-market activities. Consequently, absorption is increased and welfare gains are realised within the boundary. However, as labour is reallocated away from the non-market.activities, welfare losses take place outside the boundary. Therefore, there are positive and negative welfare effects occurring, and limiting the analysis to what happens within the production boundary is prone to biases.

This chapter aims at investigating the implications of different labour market conditions and assessing the biases of limiting the analysis of simulation results to what happens within the production boundary. Four stylized specifications of the labour market conditions are considered. The case study is the West Bank labour markets, which are described in detail in Chapter 4 of this thesis. The labour markets in the West Bank are a typical case of dual markets with Palestinian labour employed in the domestic West Bank markets as well as in Israel. Due to the importance of labour income earned in Israel for the Palestinian households, changes in the level of Palestinian employment in Israel have considerable effects on the West Bank economy. Moreover, depending on the time horizon of the analysis, different assumptions can be made about the labour market conditions in the West Bank. Subsequently, the case of the labour markets in the West Bank is well suited for the analysis intended in this chapter.

The next Section, 6.2, provides a brief overview of the four stylized specifications of the labour markets. Section 6.3 presents the data used as benchmark, the model, the closures and factor market clearing equations in each of the model specifications. Section 6.4 describes the simulation implemented. Section 6.5 analyses the main results, while Section 6.6 draws on the main conclusions and policy implications of the case study.

6.2. Stylized specifications of the labour market conditions

This section provides a brief overview of four stylized specifications of the labour market conditions that are: i) fixed supply, ii) surplus labour, iii) upward-sloping labour curve, and iv) labour-leisure trade-off. A more detailed description of these market conditions is provided in Section 3.3.2 of Chapter 3.

The fixed supply specification assumes a perfectly inelastic labour supply curve, implying that households are indifferent to changes in wages when making decisions in the labour markets. This assumption excludes the possibility for labour to be unemployed and ignores the alternative uses of time other than employment in the market activities. Traditionally, this has been relaxed by the assumption of a surplus labour that can be drawn into employment at no marginal cost. This assumption corresponds to a perfectly elastic labour supply curve, implying that once the quantities of labour needed in the market activities are determined, households must supply the corresponding quantities of labour.

A common limitation of the fixed labour supply and surplus labour assumptions is that they assume a superficial neutrality between labour uses within and outside the SNA production boundary. The fixed labour supply assumption achieves this neutrality by assuming a strict separability between labour uses within and outside the boundary. This treatment is open to challenges, even in economies with no involuntary unemployment, as it makes household decisions on the allocation of labour indifferent to changes in the wage rates. The surplus labour assumption achieves the neutrality by assuming labour to have zero opportunity cost outside the production boundary. This assumption is unlikely to hold, since labour not employed within the production boundary is often engaged in activities producing services for the use of the household. Subsequently, transferring labour across the boundary creates welfare losses outside the boundary that are not accounted for (McDonald, 2018).

The upward-sloping curve, similar to the surplus labour assumption, also implies a transfer of labour across the SNA production boundary. While this approach recognises that additional employment within the SNA production boundary has a positive price, it assumes the opportunity cost of that labour outside the SNA boundary to be zero (Aragie *et al.*, 2017). Hence, this treatment is not neutral to the welfare generated outside the boundary. Additionally, the theoretical and behavioural assumptions for the use of the wage curve are not supported by standard economic theories.

The labour-leisure trade-off approach is a way for accounting for households' full time endowment. It allows the substitution between uses of labour within and outside the production boundary. Accordingly, it reflects the trade-off facing households in the determination of the amount of labour to supply to the market. The approach also defines household utility at full consumption by considering household consumption of services produced by the activities outside the production boundary. The opportunity cost of labour use outside the production boundary is explicit and corresponds to the market wage. The labour-leisure trade-off is consistent with the standard economic theories and accounts explicitly for welfare changes within and outside the production boundary.

6.3. Methods

6.3.1. Data

The SAM used as a benchmark for the models in this chapter is an aggregated version of the detailed SAM described in Chapter 5. It comprises 183 accounts, among which 48 are commodity groups produced by 36 activities. Two foreign accounts are included for Israel and the rest of the world to depict the customs envelope between Palestine and Israel and the interdependency of their labour markets. The SAM encompasses 33 production factor accounts of which 31 are labour groups, besides two accounts for capital and land. Foreign labour is separated from the domestic labour, which is further disaggregated based on the skill level and gender. Male workers who represent the quasi totality of Palestinian labour in Israel are further categorised based on eligibility for a work permit in Israel. Three levels of eligibility are considered based on social characteristics such as age and marital status: ineligible, weakly eligible and highly eligible. There are 20 household groups classified based on income quintile (measured as expenditure per adult equivalent), and socioeconomic characteristics of their economically active members.

This database is used to calibrate the models with fixed supply, surplus labour and upward-sloping curve specifications. For the model specification with labour-leisure trade-off, a few changes to the database are required to incorporate leisure activities and commodities. Each representative household is paired with a unique activity that uses the household's own time as input to produce leisure that is consumed only by that household. The factor ownership matrix also has to be extended to account for the labour each household uses to produce leisure, in addition to the labour that is supplied to the market. For the comparability of this model results with the results of the other model specifications, the time available to households as leisure time is limited to the time endowment for their members who are not employed within the production boundary. Accordingly, the unit of labour either in employment within or outside the boundary is kept in physical number of persons. Table 6.1 summarises the employment data in the base year in the four model specifications.

Table 6.1. Employment data in the base year (unit = physical person)

		Model with fixed labour supply	Model with surplus labour	Model with upward-sloping curve	Model with labour-leisure trade-off
Employment within the SNA boundary	Domestic market activities	519,148	519,148	519,148	519,148
	Foreign market activities	74,814	74,814	74,814	74,814
Unemployment/ Employment outside the SNA boundary		0	123,892	123,892	123,892
Total		593,962	717,854	717,854	717,854

6.3.2. Model

The model used in this chapter is a modified version of the STAGE-2 model developed by McDonald and Thierfelder (2013). The basic structure of STAGE-2 is described in Section 3.6 of Chapter 3. For this chapter, the STAGE-2 model is modified to depict some special features of the Palestinian economy and its interactions with the rest of the world. First, a multiple trade partner specification is introduced to separate Israel from other trade partners. This model extension is set up in a generalised way that can support more than two trade partners. The elasticities used to account for imperfect substitution between import/export from/to different trade partners as well as between import/export and domestic supply are provided in Appendix 4. Second, the domestic production module is modified to accommodate a seven-level production process that reflects the composition of the labour force in the West Bank. Each level of the production process involves Constant Elasticity of Substitution (CES) functions. The values of the elasticities used at each stage of the production module are reported in Appendix 5.

A mobility function is incorporated in the model and is activated by changes in relative wages. The intensity of mobility is governed by a response elasticity, which is defined for each pair of market segments and captures the influence of structural features such as transaction costs, efficiency of factor markets and preferences to stay with the current occupation on labour mobility. By allowing labour to be mobile, the standard assumption of labour income being distributed to households in fixed proportions is no longer valid. Accordingly, the matrix of share coefficients controlling the functional distribution of income is replaced by a matrix of variables that tracks changes in the supply of labour in each sector and makes the labour income distribution endogenous.

6.3.3. Macroeconomic closures

The reality of the West Bank being a small player in the international markets is depicted with the small country assumption, which implies that importers and exporters in the West Bank are price takers. The model is investment-driven as investments in the Palestinian economy are largely exogenous. The share of investments in the final demand is fixed. To keep the balance between savings and investments, household and enterprise savings rates vary equiproportionately. Government savings are fixed and the direct tax rate adjusts multiplicatively to maintain the balance. Government consumption is a fixed share of the final demand. The nominal exchange rate (defined in domestic per world unit) is fixed in the model, as the Israeli Shekel is the main currency in the West Bank and given that Israel is the West Bank's main trading partne. To avoid future consumption effects, the current account balance is fixed. The consumer price index serves as the numeraire, meaning that transfers and wages are in real terms.

6.3.4. Factor market closures

The factor market closures common to all four model specifications are such that capital and land are fully employed as well as mobile across sectors and their prices are flexible. The choice of pairs of market segments and the direction of labour mobility between them follows the Kuznets' structural transformation process (Herrendorf *et al.*, 2014). Accordingly, labour can move from the agricultural sector to the manufacturing and construction sectors; from the manufacturing sector to the construction and tertiary sectors and from the construction sector to the tertiary sector. The assumption of one-way movement between the sectors follows the rationale that a labour movement to sectors at the top of the structural process is associated with changes in the living conditions. Subsequently, even with stronger positive changes in wages in the sectors at the bottom of the structural transformation process (e.g. agricultural sector), a backward movement of labour my not take place, as the workers enjoy the city life and do not see future prospects in the rural areas.

The closures governing the shape of the labour supply curve vary from one model specification to the other. In the fixed supply specification, the labour market is at full employment. Hence, the supply curve is perfectly inelastic (vertical). In the labour-leisure trade-off specification, the labour markets are also at full employment, as labour can always be employed either in the activities within the production boundary or outside the boundary. In contrast to the fixed supply specification, the supply of labour to the activities within the boundary is not perfectly inelastic, since the labour-leisure trade-off allows transfers across the boundary.

In the surplus labour and upward-sloping curve specifications, explicit unemployment of labour is considered. The size of the pool of unemployment in each labour market segment is determined based on the official data provided by the Palestinian Central Office of Statistics (PCBS, 2012e). In the surplus labour specification, a switching regime is considered. Accordingly, the labour supply function has two segments, a perfectly elastic (horizontal) one implying that additional workers can move into production at fixed real wages as long as there is unemployed labour; and a perfectly inelastic (vertical) one reflecting full employment. The choice of the switching regime allows wages to change in the domestic market, such that the model is compatible with the mobility function.

Finally, for the model specification with an upward-sloping curve, the supply elasticity is derived from empirical panel data of wages and unemployment rates in the West Bank governorates between 2000 and 2015 (PCBS, 2017e, 2017f). The variability between regions is controlled with the fixed effects estimation procedure. The estimation model is shown in Equation [6.1], where $\ln(w_f)$ is the logarithm of the wage, $\ln(urate_f)$ the logarithm of the unemployment rate, and ε stands for the fixed effects. As both the local unemployment and wage rates are entered as logarithms, the coefficient of the unemployment rate represents a proportional change and can be read off as an elasticity. The model estimates are statistically significant at the 1% level.

$$\boldsymbol{ln(w_f) = -0.072\, ln(urate_f) + \varepsilon} \qquad [6.1]$$

6.3.5. Factor market clearing equations

The initial factor market clearing equation is modified to reflect the employment of Palestinian labour in the domestic market activities and in the Israeli market. The new factor market conditions are distinct in each model specification. In the model with fixed supply, a new parameter $fd\_w_{f,w}$ is created to capture the demand of factor f in foreign region w. As a parameter, which value is set exogenously, it ensures that the model takes up the envisaged shock of increased Palestinian employment in Israel. This mechanism reflects the empirical evidence that Palestinian employment in Israel is demand-driven. The new factor market clearing equation is defined in Equation [6.2]:

$$FS_f = \sum_a FD_{f,a} + \sum_w fd\_w_{f,w} \qquad [6.2]$$

Where FS_f is the total supply of factor f, $FD_{f,a}$ is the demand of factor f by activity a within the production boundary of the domestic market, and $fd\_w_{f,w}$ is the demand for factor f in foreign region w.

In the surplus labour and upward-sloping curve specifications, a variable is added to the market clearing equation to capture the pool of labour not employed within the production boundary

$$FS_f = \sum_a FD_{f,a} + \sum_w fd\_w_{f,w} + UNEMP_f \qquad [6.3]$$

Where $UNEMP_f$ is the pool of the unemployed factor f. In the labour surplus specification, unemployment is defined as an inequality. This allows the unemployment of each factor to change subject to the condition that unemployment cannot be negative and that if there is unemployment of a factor then the real wage rate for that factor is fixed (Equation [6.4])

$$UNEMP_f > 0 \qquad [6.4]$$

In the upward-sloping curve specification, unemployment is defined by a log-linear equation (Equation [6.5]), which implies the unemployment of each factor to change subject to changes in real wages and to the pre-determined supply elasticity.

$$\boldsymbol{ln\left(\frac{WF_f*(1-TYF_f)}{CPI}\right) = \alpha_0 + \alpha_1 \, ln\left(\frac{UNEMP_f}{FS_f}\right)} \qquad [6.5]$$

where TYF_f are factor taxes, CPI the consumer price index, α_0 the intercept of the function and α_1 the wage curve elasticity for Palestine (-0.072).

In the labour-leisure trade-off specification, the market clearing equation is further modified to reflect the use of labour in activities outside the boundary, as shown in Equation [6.6]:

$$\boldsymbol{FS_f = \sum_{alein} FD_{f,a} + \sum_w fd\_w_{f,w} + \sum_{insw} FSIE_{insw,f} \quad \forall alein_a \; and \; f_{ff}} \qquad [6.6]$$

Where the factor demand $FD_{f,a}$ is only aggregated over the set $alein$, which refers to activities within the production boundary of the domestic market. $FSIE_{insw,f}$ is the pool of factor f supplied by institution $insw$ to activities outside the boundary. The demand of labour in activities outside the production boundary is defined in the Equation [6.7], where the mapping (map_hh_alei) pairs the leisure activities $alei$ with households (hh), while the set $alei$ refers to leisure activities.

$$\boldsymbol{FSIE_{insw,f} = \sum_{a\$map\_hh\_alei(insw,a)} FD_{f,a} \quad \forall alei_a \; and \; f_{ff}} \qquad [6.7]$$

6.4. Simulations

After assuring that the model replicates the original data that represents the economy in 2011, which is called "base" scenario, four counterfactual scenarios are introduced. Scenario 1 simulates a return to the *pre-intifada* level of Palestinian employment in Israel. As observed in Figure 4-2, the level of Palestinian employment in Israel has been growing since 2005 and is getting closer to its 1999 peak. While it may be argued that at some point in the future, Palestinian employment could surpass its 1999 level, most observers and scholars argue that, for political reasons, it is unlikely that the number of Palestinians permitted to work in Israel in the future exceed the pre-2000 levels (Aix Group, 2004). Therefore, the 1999 absolute number of 99,974 Palestinians from the West Bank working in Israel serve as reference for scenario 1. This corresponds to a 36% increase in the number of Palestinian workers in Israel, compared to the base, while keeping the composition of the Palestinian labour in Israel as in the base. Total factor supply is assumed unchanged. Factor income earned by Palestinians working in Israel is increased in the same proportions as their numbers (Table 6.2).

Table 6.2. Number of Palestinian workers in Israel in the base year (physical units) and in the scenario (% change compared to the base year)

	Base (unit = physical person)	Scenario (% change)
Low-skilled ineligible males	17,364	35.7%
Low-skilled weakly eligible males	19,065	35.7%
Low-skilled highly eligible males	29,128	35.7%
Low-skilled females	1,162	35.7%
High-skilled ineligible males	3,123	35.7%
High-skilled weakly eligible males	1,254	35.7%
High-skilled highly eligible males	2,559	35.7%
High-skilled females	32	35.7%
Total	73,687	35.7%

6.5. Results and analyses

This section starts with a discussion of the effects of the shock in factor markets across the four model specifications. Then, it compares the results in the commodity markets, before discussing the macroeconomic and welfare effects. Due to space contingency, results are displayed for aggregated categories. Disaggregated results are available upon request.

6.5.1. Comparative analysis of the effects in the factor markets

The four model specifications respond differently to the shock. In the model with a fixed supply, the additional Palestinian labour demand in Israel is fully drawn out of employment in the domestic West Bank market. By contrast, in the other three models, part of the extra labour demand in Israel is met with a labour that was previously unemployed in the market. In the model with a surplus labour assumption, almost all the extra Palestinian labour demand in Israel (98%) is met with labour previously unemployed in the market. In the model with an upward-sloping curve, about three quarters of the extra labour demand in Israel comes from the pool of labour that was previously unemployed in the market activities. Finally, the model with a labour-leisure trade-off indicates that 8% of the shock is met with labour that was previously unemployed in the market activities. Table 6.3 summarises these findings.

Table 6.3. Origin of Palestinian workers starting employment within the production boundary of the Israeli market

	Model with fixed labour supply		Model with labour-leisure trade-off		Model with upward-sloping curve		Model with surplus labour	
	Number	Share	Number	Share	Number	Share	Number	Share
Out of unemployment	0	0%	2,234	8%	19,551	74%	25,778	98%
Out of domestic labour market	26,287	100%	24,053	92%	6,736	26%	509	2%
Total	26,287	100%	26,287	100%	26,287	100%	26,287	100%

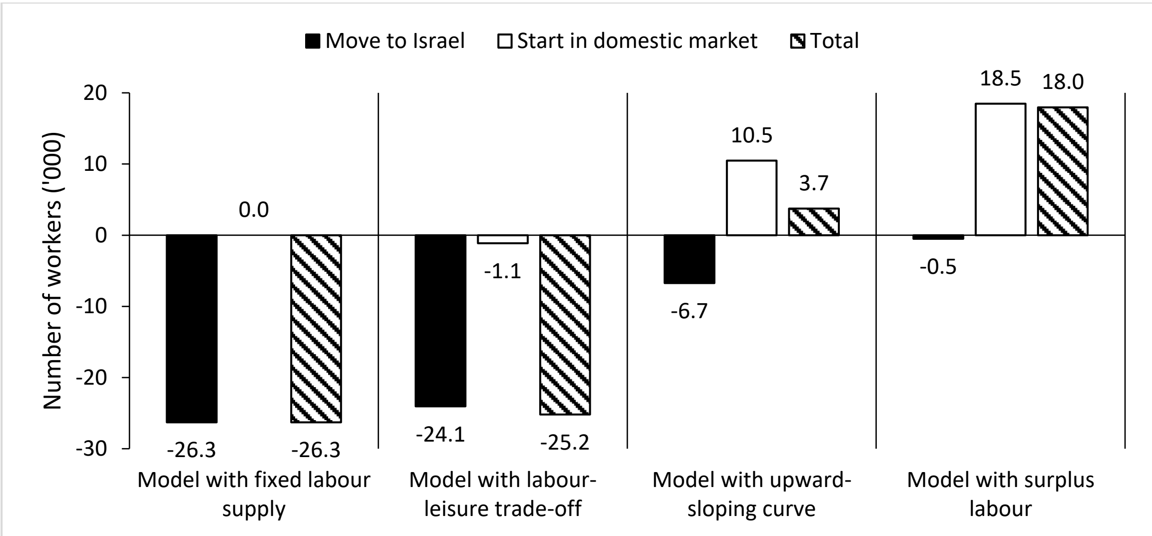
As expected, the model specifications with a fixed labour supply and a surplus labour give the extreme results. The model with a fixed labour supply, by assuming that the time available to households is fully employed in the market activities, provides for no spare capacity from which households can source the additional labour. Hence, the shock fully falls on the labour already in employment in the domestic market activities. At the other extreme, the surplus labour assumption by providing households the option to transfer labour across the SNA production boundary into market activities at zero opportunity cost generates very optimistic results with the shock having little effect on the labour already in employment in the domestic market activities.

By assuming that labour enters employment in the market activities at a positive price, the upward-sloping curve reduces the amount of labour entering employment in the market activities. Subsequently, compared to the model with a surplus labour, less workers who start employment in Israel were previously unemployed in the market activities, while more were previously employed in the domestic market activities.

Similarly, the labour-leisure trade-off assumption, implying that household members are either employed in the market activities or occupied in the non-market activities also associates a cost to transferring labour across the SNA boundary. The opportunity cost of labour in the non-market activities being equal to wages in the market activities attaches a higher cost to the transfer of labour across the SNA boundary than does the upward-sloping curve assumption. Households do respond to the shock by freeing labour out of the non-market activities to start employment in the Israeli market.

Figure 6-1 shows that while workers are switching out of employment in the domestic market activities to start employment in Israel, depending on the assumption used to model the labour supply, workers are transferred across the production boundary to start employment in the domestic market.

Figure 6-1. Movements into and out of employment in domestic market activities

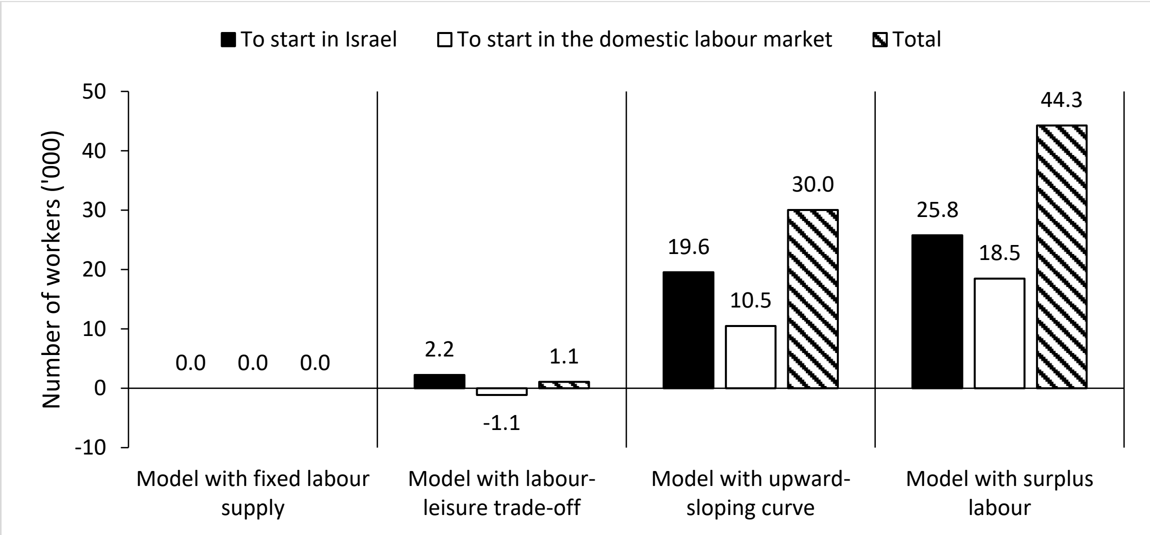


The models with a surplus labour and an upward-sloping curve show that the number of workers leaving employment in the domestic market activities is overcompensated by new workers who were previously occupied in the non-market activities. As expected, the number of these new workers is substantially larger in the model with a surplus labour.

Under a fixed supply assumption, there is no additional worker starting employment in the domestic market, since the supply of labour is fixed and the labour is fully employed. By contrast, the model with a labour-leisure trade-off shows that workers are displaced out of employment in the domestic market. In other words, employment in the domestic market is not only reduced by the number of workers switching to employment in Israel, but it is further reduced by the number of workers households remove from employment in the domestic market activities to generate more leisure outside the production boundary.

The insights from Table 6.3 and Figure 6-1 indicate that under the assumptions of surplus labour and upward-sloping curve, part of the labour transferred across the production boundary into the market activities start in the Israeli market, while another part start in the domestic market. Hence, the extra Palestinian labour demand stimulates the domestic economy, with employment in the domestic market activities growing thanks to the relative easy transfer of labour across the boundary. By contrast, with a labour-leisure trade-off assumption, the amount of labour transferred by households from the non-market activities to the Israeli market is partially offset by the withdrawal of labour from the domestic market activities into the non-market activities. Figure 6-2 summarises the findings related to the pool of labour used in the non-market activities.

Figure 6-2. Labour movements into and out of non-market activities



6.5.2. Comparative analysis of the outcomes on factor prices, output and demand

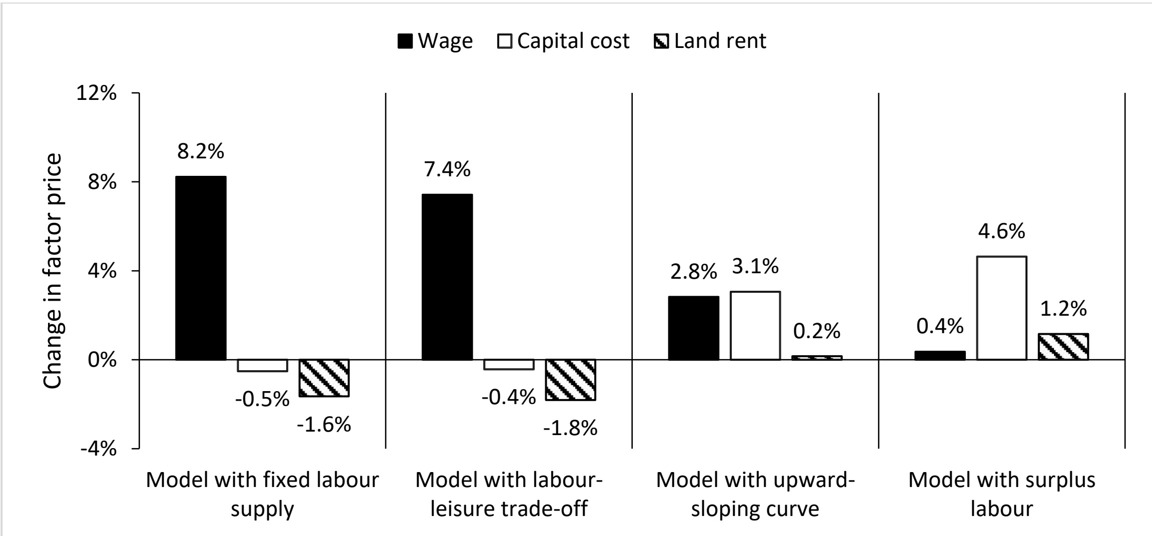
The assumption made about the conditions of the labour market has direct implications on the factor prices.

When a fixed labour supply is assumed, the extra Palestinian labour demand in Israel triggers a substantial increase in wages by 8.2% on average. At the other end of the spectrum, assuming a surplus labour barely affects wages, which increase only by 0.4% on average. Under a surplus labour assumption with switching regime as implemented here, wages start to increase only when the pool in non-market activities is fully transferred into the market activities.

Between these two extremes, the labour-leisure trade-off and upward-sloping curve assumptions increase wages, while transferring labour across the boundary. Since the labour-leisure trade-off has an explicit and high opportunity cost for labour in the non-market activities, it is associated with less transfer of labour across the boundary and a higher increase in wages compared to the outcomes of the model with an upward-sloping curve. The average wage increases by 7.4% if the labour-leisure trade-off assumption is used, and by 2.8% if the upward-sloping curve assumption is used.

The prices of capital and land increase under a surplus labour and an upward-sloping curve, while they decrease under a fixed supply and a labour-leisure trade-off assumptions (Figure 6-3).

Figure 6-3. Change in factor prices



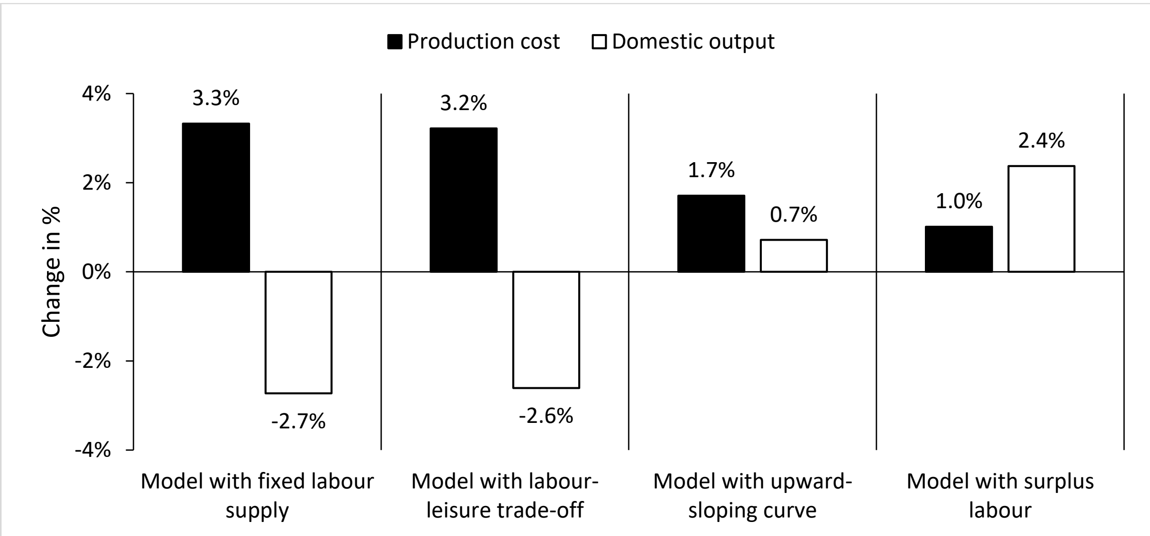
Under the surplus labour and wage curve assumptions, the domestic economy is booming and the domestic market activities increase demand for all production factors. For labour, this increased demand is met with a transfer of labour from the non-market activities into the domestic market activities (see Figure 6-2). For capital and land, the increased demand is only reflected into factor price increases as the markets for capital and land are assumed in full employment.

Under the fixed supply and labour-leisure trade-off assumptions, the domestic economy slows down. This is marked with a reduced demand for all production factors. Consequently, in both model specifications, the prices of capital and land decrease. Under the labour-leisure trade-off, the reduced demand is also reflected in the labour markets by a reduction in the employment of labour in the domestic market activities (see Figure 6-2).

The increase in factor prices, especially wages under the fixed supply and labour-leisure trade-off assumptions, and capital rent under the surplus labour and upward-sloping curve assumptions generates an increase in the production cost across the four models. The production cost increases more under the fixed supply and labour-leisure trade-off assumptions than under the surplus labour and upward-sloping curve assumptions. This finding stems from the fact that labour is the major production input in the West Bank and its price increasing substantially under these assumptions.

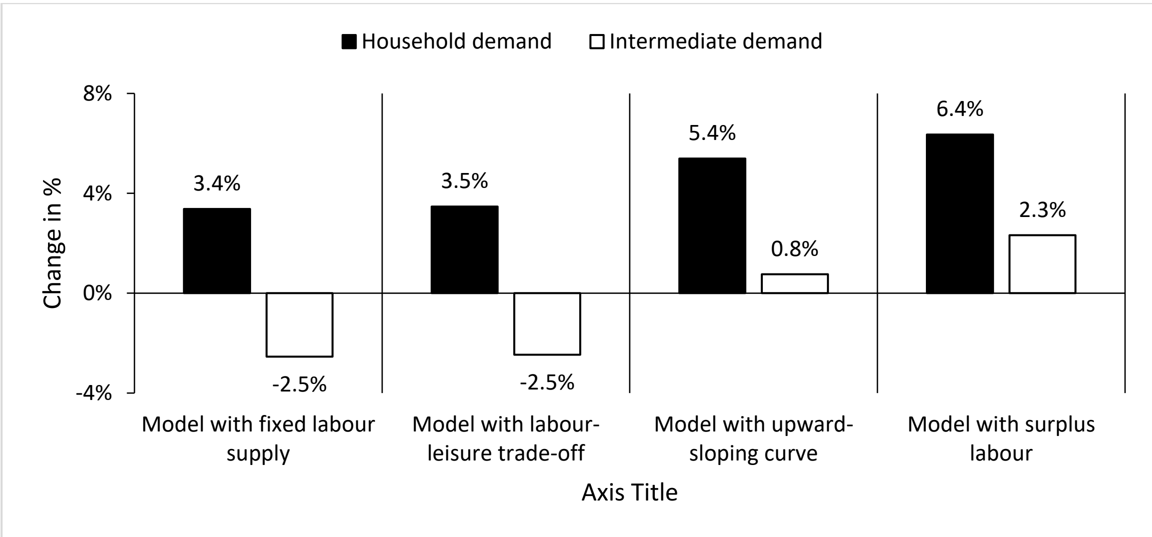
Figure 6-4 shows that the domestic market output decreases under the fixed supply and labour-leisure trade-off assumptions, while it increases under the surplus labour and upward-sloping curve assumptions. This finding is not only associated with the change in the production cost, but also with signals coming from the demand side. In fact, the increased production under the surplus labour and upward-sloping curve assumptions, despite the increase in the production cost can only be substantiated with the fact that demand in the economy is increasing. Especially, household consumption is surging due to additional income derived by households from labour employed in Israel and in the domestic market activities. By contrast, under the fixed supply and labour-leisure trade-off assumptions, household demand is also increasing, but that increase is only driven by the additional income from Israel, while the income generated in the domestic market activities decreases. Subsequently, the signals from the demand side are not strong enough to stimulate the domestic market production.

Figure 6-4. Changes in production cost and domestic market output



Across the four model specifications, household consumption of goods and services increases (Figure 6-5). This finding mainly stems from households deriving additional labour income from Israel. In the two model specifications with a surplus labour and an upward-sloping labour supply curve, household consumption of goods and services increase substantially more than in the model specifications with a fixed labour supply and a labour-leisure trade-off. In the latter two model specifications, households generate relatively less income. Although wages increase strongly in these two model specifications, the labour exiting employment in the domestic market activities is not replaced. By contrast, in the model specifications with surplus labour and upward-sloping labour supply curve, not only factor prices increase (see Figure 6-3), but also the labour exiting employment in the domestic market activities to Israel is overcompensated by a movement of labour from the non-market activities into the domestic market activities (see Figure 6-1). Accordingly, households derive more income from employment in the domestic market, and can consume more.

Figure 6-5. Changes in household consumption and in intermediate input demand



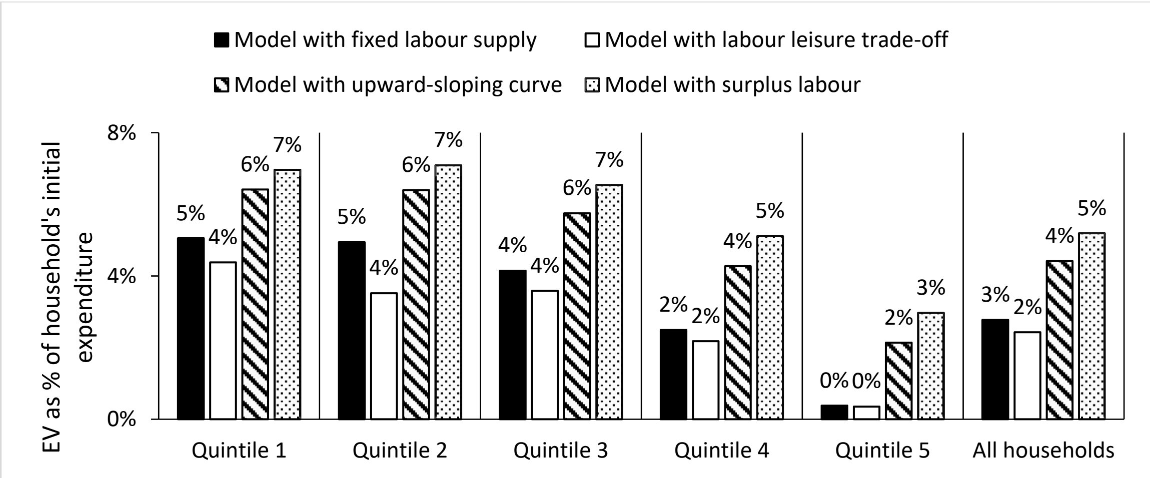
While the change in household consumption of goods and services produced by the market activities can be captured in all model specifications, the change in the consumption of services produced by the non-market activities can only be captured by the labour-leisure trade-off specification. The model results show that household consumption of leisure decreases by 1%, which is consistent with the finding in Figure 6-2 that households now supply labour out of the non-market activities to the market activities, especially for employment in the Israel market.

Figure 6-5 also highlights that the demand for intermediate inputs decreases in the model specifications with fixed labour supply and labour-leisure trade-off, while it increases in the model specifications with a surplus labour and an upward-sloping labour supply curve. This finding is related to changes in the domestic production. In the model specifications with a fixed labour supply and a labour-leisure trade-off, domestic output decreases (see Figure 6-4) and accordingly demand for intermediate inputs by domestic market activities also decreases. The opposite holds for the model specifications with a surplus labour and an upward-sloping labour supply curve.

6.5.3. Welfare effects

In the four model specifications, welfare effects measured by the Slutsky Equivalent Variation [10] as a share of initial household expenditure are positive for all household groups. This is an indication that additional Palestinian labour demand in Israel improves welfare of Palestinian households. Figure 6-6 shows that in all four model specifications, welfare gains are higher for the poor households in the lowest quintile than for the rich households in the top quintile. This is also an indication that Palestinian employment in Israel has income distribution effects and can serve as a lever to fight poverty and inequality.

Figure 6-6. Welfare effects measured in equivalent variation as share of initial household expenditure



A comparative analysis of the four model specifications show that the models with a surplus labour generates the highest welfare gains for the Palestinian households. Knowing that this model specification is assumed to have zero opportunity cost for labour in the non-

[10] The Equivalent Variation is defined as the amount of compensation, that must be added (subtracted) to (from) the household's initial income, to leave him as well off as under the combined price and income changes.

market activities and that the surplus labour can enter employment in the market activities at fixed real wages, it is expected to lead to optimistic results. The expected biases of this model specification tend to overestimate household welfare gains (McDonald, 2018).

The model specification with an upward-sloping curve gives the second highest household welfare gains. While this model specification acknowledges that labour enters employment in the market activities at a positive price, it considers labour to have zero opportunity cost in the non-market activities. Hence, the utility foregone by households when transferring labour across the boundary is zero. Subsequently, the welfare estimates are also high.

The model specification with a fixed supply assumes a strict separability between the contributions to welfare from activities within and outside the production boundary (McDonald, 2018). Hence, this treatment is neutral with respect to the welfare generated outside the production boundary. Nevertheless, the assumption that there are no trade-offs between uses of labour within and outside the production boundary is open to challenges and the welfare results are – thus – not optimal estimates of the household welfare gains.

The model specification with a labour-leisure trade-off generates the welfare results that account for changes occurring both within and outside the SNA production boundary. As additional Palestinian employment in Israel increases domestic wages, households allocate more labour to market activities at the expense of non-market activities. This reallocation enables households to generate more income and increase consumption of goods and services, which increases their utility. However, the utility derived from services produced by the non-market activities decreases. The outcome is an increase in welfare at the level of all household groups. The net welfare effects, which include the losses occurring outside the production boundary, have a lower magnitude than the welfare estimates found in the other model specifications.

6.5.4. Macroeconomic aggregates

The macroeconomic aggregates show that, in the four model specifications, absorption increases at constant domestic prices. This increased absorption is met with increased import demand and a partial reallocation of domestic production towards domestic consumption at the expense of the export market. The export supply falls in all model specifications. This result is consistent with both empirics and theory, since the inflow of labour income from Israel has "Dutch disease" effects through a real appreciation of the domestic currency and a reduced competitiveness of the Palestinian exports in the international markets. The real GDP declines in the model specifications with a fixed supply and a labour-leisure trade-off, and increases in the model specifications with a surplus labour and an upward-sloping curve (Table 6.4).

Table 6.4. Changes in macroeconomic aggregates in real terms

	Model with fixed labour supply	Model with labour-leisure trade-off	Model with upward-sloping curve	Model with surplus labour
Absorption	2.2%	2.3%	4.5%	5.7%
Import demand	2.1%	2.2%	4.2%	5.2%
Export supply	-17.5%	-17.0%	-10.5%	-7.3%
GDP	-1.8%	-1.6%	1.7%	3.4%

The model specification with a surplus labour exhibits the highest increase in absorption. This finding is as expected, because this model specification tends to overestimate the positive growth effects of labour mobility. By assuming that labour has zero opportunity cost in the non-market activities and can be employed in the market activities at fixed real wages, the surplus labour specification tends to overestimate the number of workers who are transferred across the production boundary. Subsequently, the additional income accruing to households, as well as changes in absorption, are high. Changes in import demand tend to be overestimated, while changes in export supply are likely to be underestimated. Finally, changes in real GDP are also high.

The model with an upward-sloping curve also tends to overestimate the positive growth effects of labour mobility. Its underlying assumptions are that the opportunity cost of labour in the non-market activities is zero, and that labour enters employment in the market activities at a positive price. Such assumptions are not only inconsistent, but also generate increases in the measured absorption that are – at least in part – realised from a reduction in the contribution of the welfare derived by households from the activities outside the boundary (McDonald, 2018). Subsequently, the change in real GDP is likely to be overestimated.

The model with a fixed supply specification tends to underestimate the positive growth effects of labour mobility, because of the strict separability it assumes between the labour uses within and outside the production boundary. Such an assumption causes the full shock to be borne by the labour already in employment in the domestic market activities. Subsequently, there is a huge exit from employment in the domestic market, and less income generated. Accordingly, the model results are likely to underestimate the total household factor income and its subsequent effects on absorption and GDP.

From a theoretical point of view, the model specification with a labour-leisure trade-off generates the most consistent results, we argue. The increased Palestinian labour demand in Israel raises the domestic wages. In response, households allocate more labour to the market activities. From this reallocation, more income is generated, and absorption as well as import demand increase. The export supply decreases, because the large inflows of labour income from Israel cause a real appreciation of the domestic currency. Moreover, the "Dutch disease" effects of Palestinian employment in Israel reduce incentives to work in the domestic market activities, with as outcome a decline in the domestic market output. Ultimately, the GDP decreases.

6.6. Conclusions and policy implications

The objective of this chapter is to analyse empirically how different labour market specifications affect the simulation results in CGE models, using the case study of Palestinian employment in Israel. Four model specifications are considered: a fixed labour supply, a surplus labour, an upward-sloping curve and a labour-leisure trade-off. The shock implemented in the four models is a return of the Palestinian employment in Israel to its *pre-intifada* level of 1999. This corresponds to a 36% increase in the level of Palestinian employment in Israel in the reference year of the social accounting matrix (year 2011).

The results show some common trends across the four model specifications. First, the increased Palestinian labour demand in Israel increases domestic wages. Second, the additional inflow of labour income from Israel improves household welfare in the West Bank. Third, increasing employment of Palestinians in Israel exhibits the "Dutch disease" effects through a real appreciation of the domestic currency, which reduces the competitiveness of Palestinian exports in the international markets.

Beside these common trends, several differences are observed in the results of the four model specifications. Although these differences partially depend on the parametrization of each of the model specifications, several conclusions can be drawn.

In the model specification with a surplus labour, the estimated change in wage rates is low because under this specification, wages start to increase only after the pool of labour in non-market activities is emptied. The estimated number of workers transferred across the SNA boundary is high because the assumption that labour in the non-market activities has zero opportunity cost and can be transferred into the market activities at zero marginal cost is too optimistic. Subsequently, the estimated welfare gains are high, as well as changes in absorption and GDP.

The model specification with an upward-sloping curve assumes also that labour in the non-market activities has zero opportunity cost, but this labour enters employment in the market activities at a positive price. Hence, the framework has some inconsistencies, and changes in labour supplies are introduced as “manna from heaven” (McDonald, 2018). As increased employment of Palestinians in Israel increases domestic wages, additional labour is supplied to the market activities. Increases in absorption are – in part – realised from a reduction of welfare that is generated outside the production boundary. Subsequently, the estimated welfare gains, as well as changes in absorption and real GDP, are high.

The fixed supply specification assumes a strict separability between the labour uses within and outside the production boundary. Hence, this treatment is neutral to welfare changes occurring outside the production boundary. However, the presumption that the labour supply is inflexible is open to challenges, even in societies with no involuntary unemployment. A consequence of this assumption is that the full shock of increased demand for Palestinian labour in Israel has to be drawn out of the pool of employment in the domestic West Bank market activities. Accordingly, there is a huge exit from the domestic market, such that the estimated changes in wage rates are high. The welfare estimates are not optimal. Changes in absorption and in real GDP are underestimated.

The labour-leisure trade-off explicitly attaches an opportunity cost to labour in the non-market activities. As increased demand for Palestinian employment in Israel increases domestic wages, households allocate more labour to the market activities. This reallocation enables households to derive additional income and to increase consumption. Consequently, household utility is increased and welfare gains are generated. However, as less labour is used in the non-market activities, the welfare derived by households from services produced by these non-market activities decreases. The outcome is – nonetheless – an increase in the household welfare.

The labour-leisure trade-off is the most appealing framework to model labour markets because it explicitly recognises the trade-off facing households between consuming more leisure (i.e. services produced by the non-market activities) and supplying more labour to the market activities. This trade-off facing households in the real life is absent from the other model specifications. Moreover, the labour-leisure trade-off recognises households as the active agents in the operation of labour markets. They allocate labour based on changes in wage rates as well as changes in their total utility, including the utility derived from the non-market services.

While the fixed labour supply assumption also recognises households as the active agents, it assumes that households allocate the same amount of labour regardless of the changes in wage rates in the market. This assumption is open to challenges.

The two specifications of surplus labour and upward-sloping curve implicitly assume households to be passive agents in the operations of the labour markets. This behavioural relation runs counter to the theoretical foundations of CGE modelling (McDonald, 2018).

Moreover, while the fixed supply specification assumes a perfectly inelastic labour supply, the surplus labour assumes a perfectly elastic one. The two specifications can be regarded as extreme cases, with the fixed supply representing a society with no involuntary unemployment, while the surplus labour represents a society with plenty of involuntary unemployment. The upward-sloping curve is regarded as an intermediate solution providing some reflection of the empirical evidence that changes in the wage rates influence the supply of labour. However, its behavioural and theoretical foundations are not located in standard economic theories and its use can only be rationalised with the non-competitive theories of the labour market such as the union bargaining power, efficiency wage and labour contract analytical frameworks (Blanchflower and Oswald, 1995). Moreover, the opportunity costs of changing the quantities of labour supplied to the market activities are not included in the model, leading to welfare leakages. In this respect, the labour-leisure trade-off provides a theoretically consistent specification for reproducing the empirical evidence that changes in wage rates influence household decisions in the labour markets.

Two problems associated with the use of the labour-leisure trade-off are worth mentioning. The first is the incompatibility with involuntary unemployment since labour can always be employed either in the market or non-market activities. The second problem is that the definition of price in the labour-leisure trade-off approach may be subject to criticism. The valuation of the appropriate opportunity cost of labour in the non-market activities is open to challenges. By default, the market wage rates are used for the valuation of the opportunity cost of labour in the non-market activities. This valuation ignores potential non-monetary benefits of employment, and its value overstates the real opportunity cost of labour outside the boundary if involuntary unemployment is present in the economy (Posnet and Ian, 1996). In part, the criticisms about the valuation of the opportunity cost of labour are offset by using linear homogenous models, implying that only changes in relative prices determine changes in allocations (McDonald, 2018).

The choice of the relevant specification to use depends on the particularities of the economy under investigation and on the time horizon of the analysis. In the context of the Palestinian economy, in the short-term, several empirical studies show a close correlation between the employment of Palestinians in Israel and the involuntary unemployment in the West Bank (Bulmer, 2003; Etkes, 2012). The limited number of work permits and the high wage premium offered in Israel create incentives for Palestinian workers to queue for jobs in Israel instead of looking for employment in the domestic market. Moreover, the small size of the domestic market and the volatility of employment in Israel at times of conflict between the two parties create a large pool of involuntary unemployment that cannot be absorbed by the domestic market. Since the labour-leisure trade-off is incompatible with involuntary unemployment, the labour surplus specification is a suitable alternative to representing the labour markets in the West Bank in the short-term.

In the long-term, however, assuming that the level of Palestinian employment in Israel is stable, and that the factor markets are fully flexible – such that the allocation of labour between the market and non-market activities is unconstrained by the access to paid employment or self-employment – then the use of the labour-leisure trade-off is suitable.

Under these considerations, the analysis of the short-term effects with the labour surplus specification shows that the West Bank economy benefits from an increased Palestinian employment in Israel. The unemployment rate decreases as more labour starts employment in the market activities either in Israel or in the domestic market. Both the domestic market output and total absorption increase. Ultimately, real GDP increases. By contrast, long-term analysis, using the labour-leisure trade-off, shows that the supply of labour by households to the market activities is quite stable in the long-term. Only few workers are taken out of the non-market activities. Most of the increased Palestinian employment in Israel is met with workers who are shifted from employment in the domestic market to the Israeli market. This finding stems from the "Dutch disease" effects of the Palestinian employment in Israel, which reduces incentives to work within the production boundary by increasing the price of non-traded commodities, of which leisure is the most non-traded. Consequently, domestic output drops and real GDP decreases.

These findings highlight the empirical evidence of short-term benefits from the increased Palestinian employment in Israel and the long-term harm to the West Bank economy. While, in the short-term, the large inflows of labour income from Israel boost absorption and stimulate the growth of the West Bank economy, in the long-term the wage premium received in Israel raises the reservation wage in the domestic market. Subsequently, investors and domestic employers have less incentives to hire labour and invest in the domestic production. Moreover, the real appreciation of the domestic currency, due to the inflow of labour income from Israel, reduces the competitiveness of the West Bank export industry.

In addressing the challenge of maximising the benefits of Palestinian employment in Israel for the Wet Bank economy, while minimising the negative impact in the long-term, the Palestinian National Authority could introduce a tax on Palestinian labour that is employed in Israel. The tax revenue will be used to finance policy schemes that incentivise domestic employers in upgrading their production technologies. Such policy schemes will restore the competitiveness of the Palestinian export industry in the international markets, enlarge the size of the domestic market such that it can offer more job opportunities for returning workers displaced from employment in the Israeli market. Moreover, the tax – by reducing the wage premium for Palestinians in Israel – could gradually reduce the attractiveness of Palestinian employment in Israel, especially for the most skilled Palestinian workers, and reduce the dependency on the Israeli labour markets.

7

SHORT-TERM EFFECTS OF PALESTINIAN EMPLOYMENT IN ISRAEL ON THE WEST BANK ECONOMY[11]

[11] Parts of this chapter have been published as a conference paper: Agbahey, J., Siddig, K., Grethe, H., McDonald, S., 2018. Labour exports from Palestine to Israel: a boon or bane for the West Bank economy. In: 30th International Conference of Agricultural Economists (ICAE). Vancouver: International Association of Agricultural Economists (IAAE), p.25.

Chapter 7 Short-term effects of Palestinian employment in Israel on the West Bank economy

7.1. Introduction

A significant share of the employment opportunities for West Bank workers is located in the Israeli labour market. In 2011, some 14 percent of the employed persons in the West Bank were employed in Israel and accounted for some 22 percent of all labour income realised by West Bank workers; even though it has been estimated that wages for West Bank workers in Israel are 20 – 40% lower than those of Israeli workers for the same jobs (Arnon and Bamya, 2007). Despite the wages earned in Israel being relatively low by the Israeli standards, they are relatively high compared to wages in the West Bank. Consequently, there are strong incentives for Palestinians to seek employment in Israel. On the other hand, West Bank workers are a relatively cheap source of labour to the Israeli economy. The competition between West Bank and Israeli labour is limited due to the fact that West Bank employees in Israel are largely confined to the manual sectors of construction and agriculture (Miaari and Sauer, 2011), where the domestic Israeli labour supply falls short of demand (Rosenhek, 2006).

Although Palestinian employment in Israel is beneficial for both sides, for security reasons, Israel started to impose strict restrictions on the free movement of people, goods and services between the Israeli and Palestinian territories in 1991 during the Gulf war (Aranki, 2006). For Palestininas, individual work permits control access to the Israeli labour market. The permits are issued in response to requests from Israeli employers and are conditional upon a security clearance from the Israeli military establishment. Accordingly, for Palestinians, the labour market in Israel is an administered market and the operation of which is subject to political decisions taken in Israel over which the Palestinian National Authority (PNA) has little or no control. Thus, the West Bank labour market and economy experience substantial fluctuations when access for Palestinians to the Israeli labour market is changed by a legislative fiat. Nevertheless, the Palestinian workers enjoy a preference in the Israeli labour markets over other foreign workers, because they have a longer employment history with Israeli employers and are considered more experienced (Arnon and Weinblatt, 2001). Subsequently, employment of Palestinian labour in Israel is likely to remain sizeable.

This chapter explores the short-term implications for the West Bank economy consequent upon changes in the number and composition of Palestinian labour employed in Israel. Previous studies that addressed this question either did not account for the multiplier effects of the additional labour income earned in Israel (Bulmer, 2003; Etkes, 2012; Mansour,

2010) or addressed it from the perspective of the Israeli economy (Flaig *et al.*, 2013a). Subsequently, this thesis recognises the importance of developing a model for the West Bank with detailed representation of the linkages between the Israeli and Palestinian labour markets in order to investigate adequately the economy-wide effects of increased Palestinian labour flows to Israel.

The rest of this chapter is organised as follows: the next Section, 7.2, provides details about the database, the model, the macroeconomic closures, and factor market clearing equations. Section 7.3 describes the simulations. The results and their analyses are reported in section 7.4, which also includes a subsection that reports on the results of the sensitivity analyses. The last section, 7.5, considers the policy implications and some concluding remarks.

7.2. Methods

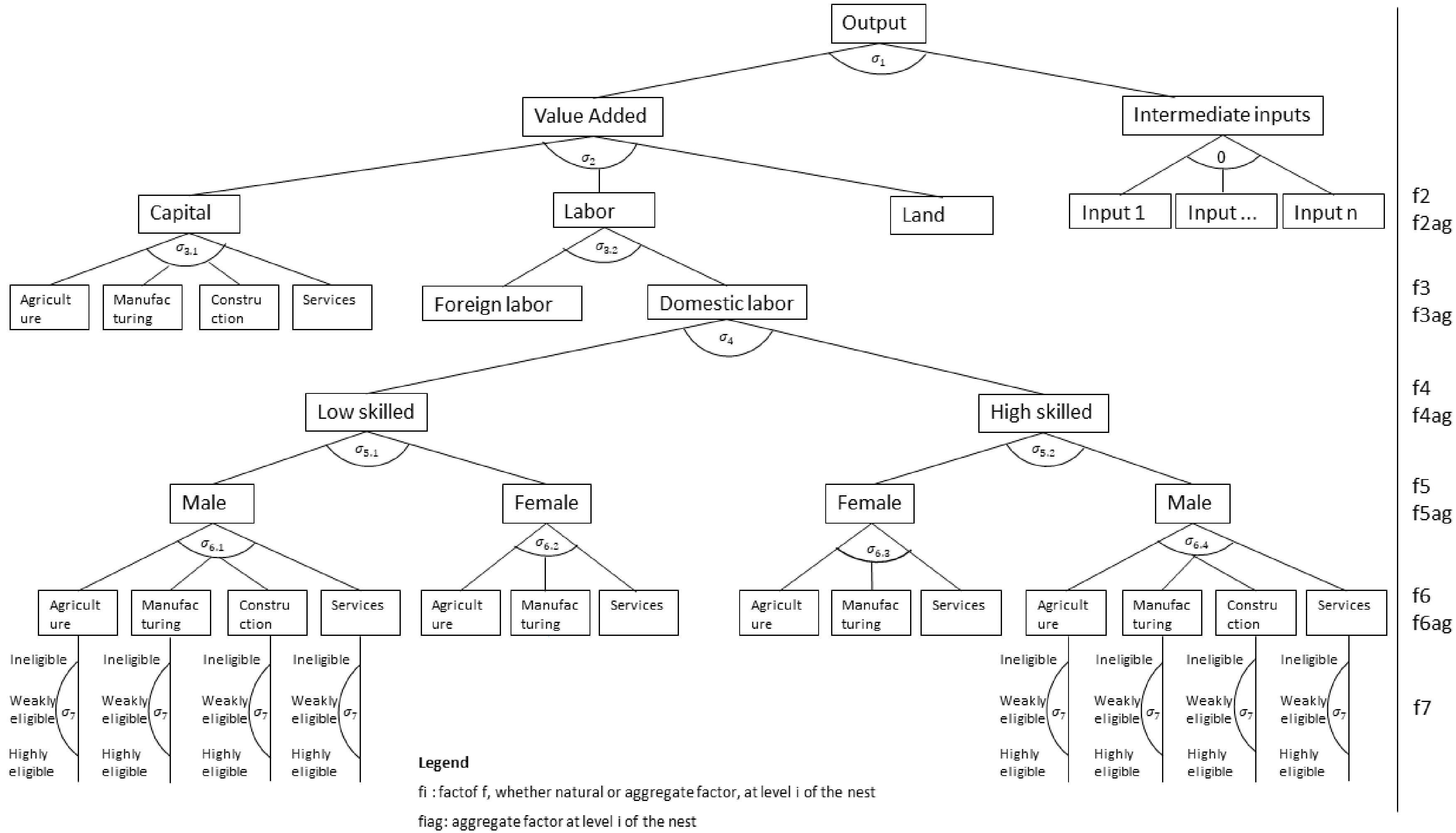
7.2.1. Data

The database used in this chapter is an aggregated version of the detailed SAM described in Chapter 5. The aggregation is identical to the one in Chapter 6 and the only difference is that capital markets are segmented, as a matter of consistency with the short-term perspective of the analysis. In the same way as for labour markets, four blocks of sectors are defined for capital: agriculture, manufacturing, construction and services.

7.2.2. Model description

The model used in this chapter is a modified version of the STAGE-2 model developed by McDonald and Thierfelder (2013). The multi-trade specification introduced to the STAGE-2 model is identical to the one in Chapter 6. The elasticities used to account for imperfect substitution are the same as in Chapter 6 (see Appendix 4). The domestic production module is modified to account for the segmentation of labour and capital markets. Each level of the production process involves CES functions (Figure 7-1). The values of the elasticities used at each stage of the production module are reported in Appendix 5.

Figure 7-1. Production module nesting



Source: Own illustration

The model represents the West Bank economy in the short-term. Accordingly, factor markets are segmented with restricted mobility. In the labour markets, homogenous labour types as defined by skill, and gender are allocated to different blocks of activities. For the male workers, four blocks of activities are considered: agriculture, manufacturing, construction and services. As less than 1% of the female workers are employed in the construction sector, only three blocks of activities are considered for them: agriculture, manufacturing and services. An advantage of the segmentation approach is that it explicitly accounts for labour heterogeneity and ensures that workers with notionally identical characteristics earn different wages depending on their sector of employment. However, this approach restricts workers to their initial market segment. When the market segment includes several activities, the worker can respond to wage changes and move between activities within the segment but there is no cross-segment mobility. This short-term presumption is justified by the nature of the research question, as Palestinian employment in Israel is volatile. Similar to the labour market, the capital market is segmented into four blocks of activities: agriculture, manufacturing, construction and services, while land is only used in the agricultural sector.

7.2.3. Macroeconomic closure conditions

The reality of the West Bank being a small player in the international markets is depicted with exogenous international market prices. The model is investment-driven as investments in the Palestinian economy are largely exogenous. The share of investments in the final demand is fixed because a better economic environment in the West Bank and lower tension with Israel will generate an economic growth, higher final demand, and provide a secured environment that will attract more foreign investments. To keep the balance between savings and investments, household and enterprise savings rates vary equiproportionately. Government savings are fixed, while direct tax and value added tax rates adjust multiplicatively to maintain the balance. Government consumption is a fixed share of the final demand, such that when the final demand increases as the economy expands, the government consumption follows. This assumption is grounded in the tendency of the public sector in the West Bank to expand quickly (UNCTAD, 2006). To close the foreign market, the current account is fixed to avoid any changes in borrowing from foreign funds, while keeping all the welfare effects in the solution period. A fixed exchange rate is considered as the Israeli Shekel is the main currency in circulation in the West Bank and Israel is the dominant trade partner of the West Bank economy. Finally, the consumer price index serves as numeraire in the model.

7.2.4. Factor market closures

The factor market closures are chosen in consistency with the short-term presumption of the analysis. The labour markets are assumed rigid with the presence of involuntary unemployment. This reflects the conditions in the West Bank labour markets where highly paid but unstable employment in Israel combined with the low capacity of the domestic economy generates a high level of involuntary unemployment and above-equilibrium wages. The closures are such that labour supply and demand in the West Bank are determined given fixed real wages. This implies that the market wages in the West Bank are above equilibrium, and the unemployed labour would take employment at the current real wage rates if there were employment opportunities. A regime switching specification is adopted to avoid an infinite supply of labour. As long as there is unemployed labour, the supply curve is perfectly elastic and real wages are fixed. Once the pool of unemployed labour is empty, the supply curve becomes perfectly inelastic and any further labour demand is translated into wage increases. The size of unemployed labour in each market segment is determined based on official statistics for the West Bank in 2011 (PCBS, 2012a). In contrast to the labour markets, where there are official statistics on unemployment, there is no evidence of spare capital and land. Consequently, capital and land are assumed fully employed in their respective market segments.

7.2.5. Factor market clearing equations

To allow factor mobility between the West Bank and Israeli markets, the clearing equation for the factor market equilibrium is modified to incorporate the demand for domestic factor abroad. Accordingly, a new parameter $fd\_w_{f,w}$ is created to capture the demand of factor f in foreign region w. The new factor market clearing equation is therefore as follows:

$$FS_f = \sum_a FD_{f,a} + \sum_w fd\_w_{f,w} + UNEMP_f$$

Where FS_f is the total supply of factor f, $FD_{f,a}$ is the demand of factor f by activity a in the domestic market, $UNEMP_f$ is the size of the unemployed factor f, and $fd\_w_{f,w}$ is the demand for factor f in foreign region w.

The initial value of the parameter $fd\_w_{f,w}$ is calibrated to the base year data through a satellite account that captures the physical quantities of factor used in both the domestic and foreign markets. As a parameter, the demand for domestic factor in the foreign market can be increased or decreased exogenously. This assumes that change in the demand for domestic factor in foreign markets is met, regardless of the domestic conditions. While such assumption might not fit all the cases, it reflects well the Palestinian employment in Israel, which is mostly driven by the demand in the Israeli economy. In fact, the wages received by Palestinian workers in Israel are substantially higher than the average wage in the West Bank. Moreover, the high unemployment in the West Bank ensures that any increase in the labour demand in Israel will be met.

7.3. Simulations

After assuring that the model replicates the original data representing the economy in 2011, which is called "base" scenario, four counterfactual scenarios are introduced. Scenario 1 simulates a return to the *pre-intifada* level of Palestinian employment in Israel. The shock implemented here is the same as described in Section 6.4 of Chapter 6. Factor income from Israel for each labour group is increased in the same proportions as their numbers.

Scenario 2 assesses the effect of the same increase in the total number of Palestinians working in Israel with the only difference that for male workers, the additional number of commuters to Israel is only sourced from those who are eligible for a work permit in Israel.

Scenario 3 simulates the same shock as in scenario 1, assuming an increase in the total labour force. In fact, there is a consensus among experts from the Palestinian Central Bureau of Statistics (PCBS) that an increase in the number of Palestinians commuting to Israel for work will stimulate people currently outside the labour force to join the labour force. This assessment is supported by the low participation rate[12] in the labour force, which stands at 46% in 2011 for the West Bank (PCBS, 2012a). Evidence for growth in the Palestinian labour force in case Israel grants more work permits for Palestinians is also found in Etkes (2012), who shows that part of the new permit holders come from outside the labour force. Based on these insights, scenario 3 replicates the same shock as in scenario 1 with an increase of the total labour force by an exemplary amount of 5%.

Scenario 4 simulates a reduction in the number of Palestinian workers in Israel by 36%, assuming that Israel tightens further the conditions for Palestinian access to its market by reducing the number of permits and reinforcing the control of unpermitted workers.

Table 7.1 summarises the base values and simulations conducted on the size of Palestinian labour employed in Israel, factor income received by Palestinian households from Israel and the size of total labour force. The table presents values for aggregated labour groups.

[12] This rate is especially low among women (19%) as compared to men (71%) (PCBS, 2012a)

Table 7.1. Base values of and shocks to the number of Palestinians working in Israel, factor income from Israel and size of the labour force

	Palestinians working in Israel (base in absolute numbers; scenarios in % change)					*Factor income from Israel (base in million US$; scenarios in % change)*					*Total labour force (base in absolute numbers; scenarios in % change)*	
	Base	Scen. 1	Scen. 2	Scen. 3	Scen. 4	Base	Scen. 1	Scen. 2	Scen. 3	Scen. 4	Base	Scen. 3
Low-skilled ineligible males	17,364	36%	-	36%	-36%	240	36%	-	36%	-36%	159,210	5%
Low-skilled weakly eligible males	19,065	36%	50%	36%	-36%	279	36%	50%	36%	-36%	92,588	5%
Low-skilled highly eligible males	29,128	36%	50%	36%	-36%	442	36%	50%	36%	-36%	182,310	5%
Low-skilled females	1,162	36%	36%	36%	-36%	18	36%	36%	36%	-36%	62,451	5%
High-skilled ineligible males	3,123	36%	-	36%	-36%	47	36%	-	36%	36%	50,137	5%
High-skilled weakly eligible males	1,254	36%	50%	36%	-36%	21	36%	50%	36%	-36%	25,667	5%
High-skilled highly eligible males	2,559	36%	50%	36%	-36%	47	36%	50%	36%	-36%	60,498	5%
High-skilled females	32	36%	36%	36%	-36%	1	36%	36%	36%	-36%	84,993	5%
Total	73,687	36%	36%	36%	-36%	1,094	36%	36%	36%	-36%	717,855	5%

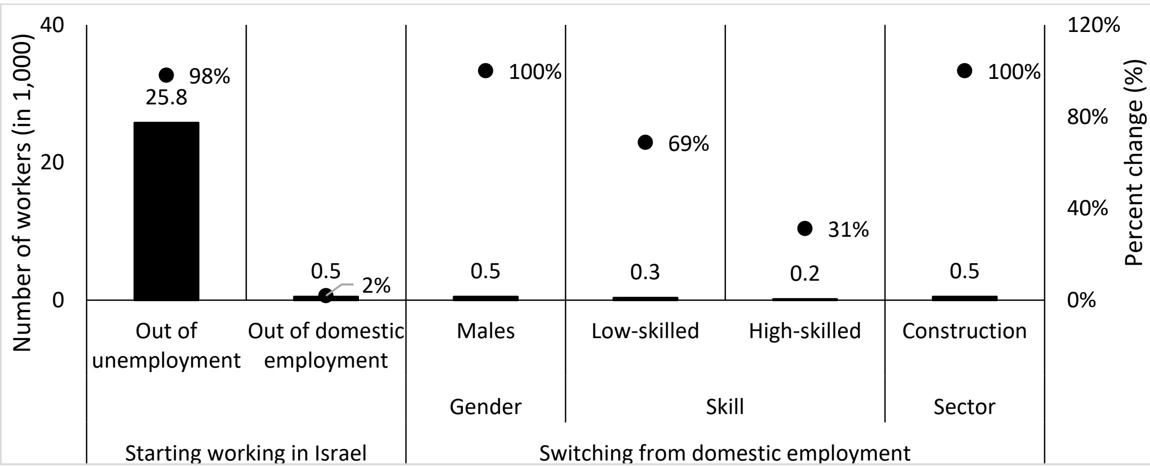
7.4. Results and analyses

This section starts by discussing the effects of scenario 1 on the factor markets, domestic output and consumption. Afterwards, it discusses the macroeconomic and welfare effects. The section ends with a discussion of the effects of scenarios 2, 3 and 4, compared to those of scenario 1. In this section, due to space contingency results are mostly displayed for aggregated categories. Disaggregated results are available upon request.

7.4.1. Effects on the factors markets

The extra Palestinian labour demand in Israel is met in one part with labour moving out of unemployment and in another part with labour switching from employment in the domestic market to employment in Israel. Figure 7-2 shows that the majority (98%) of Palestinians starting employment in Israel move out of unemployment. Figure 7-2 also highlights that those who switch out of domestic employment for employment in Israel are all males previously employed in the construction sector and are mostly low-skilled workers.

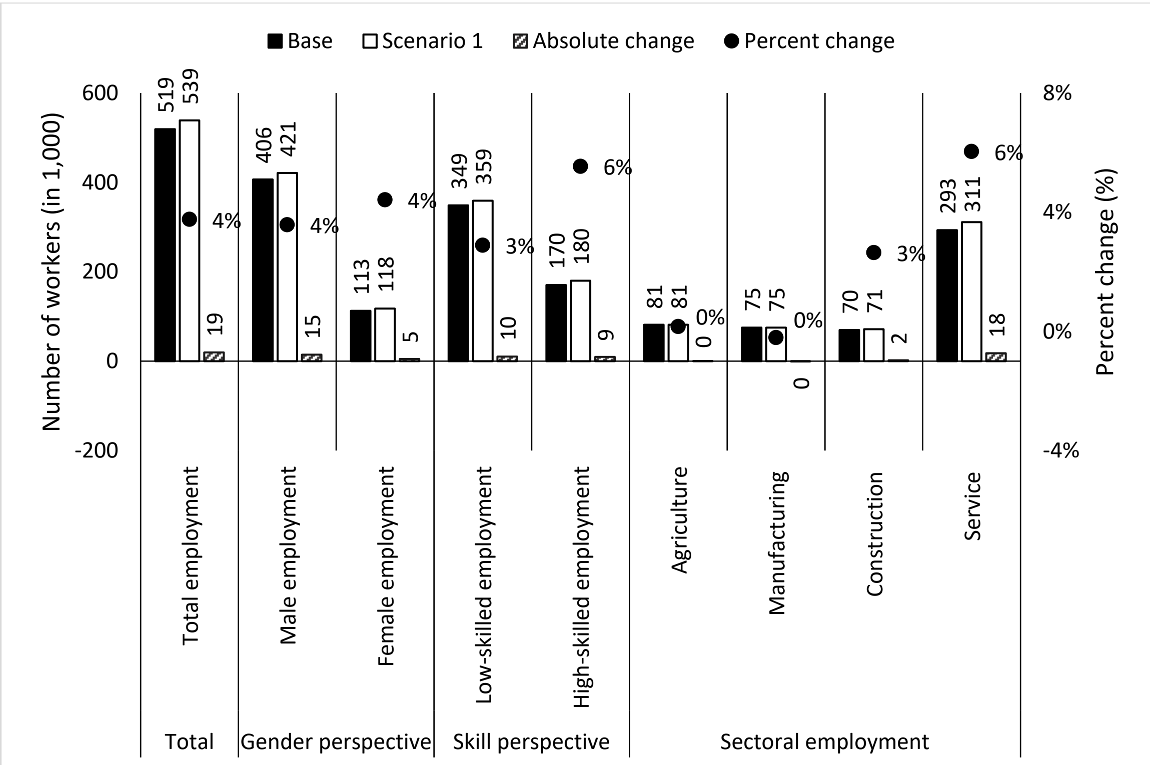
Figure 7-2. Characteristics of workers starting to work in Israel (in 1,000) and shares with respect to selected characteristics (in %)



The number of Palestinian workers who switch from employment in the domestic market to the Israeli market represent 0.1% of the initial number of workers in the domestic market. This finding is arguably a lower bound estimate of what will happen in the real world, because the surplus labour assumption used to depict the labour market conditions in the West Bank first matches the extra labour demand in Israel with the unemployed labour. While this assumption may overstate the effect on the pool of labour starting employment in Israel, it reflects the empirical evidence of a strong short-term correlation between unemployment in the West Bank and the access of Palestinian labour to the Israeli markets (see Figure 4-2). Unemployment in the West Bank is mostly involuntary. Subsequently, an improved access to the Israeli market will provide more incentives to the unemployed labour than to the labour already in employment in the domestic market. Moreover, among the unemployed are persons previously working in Israel, who returned to the domestic West Bank market after the tightening of access to the Israeli market. Not having found a job in the domestic market, they became unemployed and are therefore likely to be among the first to take jobs in Israel if access to the Israeli market is improved.

The increased Palestinian employment in Israel increases labour income and ultimately total household income, allowing households to consume more goods and services. Consequently, both import demand and demand for domestically produced commodities increase. For domestic production, this translates into increased employment of labour in the domestic market by 4%. This increase is higher for high-skilled workers than for low-skilled workers and higher for female workers than for males workers (Figure 7-3). This result is consistent with the empirical evidence that the domestic market offers more suitable employment opportunities for the high-skilled workers, as well as female workers (Etkes, 2012).

Figure 7-3. Number of domestically employed in the Base & Scenario 1 (in 1,000) as well as change (in 1,000 & %)



Employment in the domestic market increases strongly in the service sector and moderately in the construction sector. However, it remains almost unchanged in the manufacturing and agricultural sectors. These findings partially stem from the income elasticities (see Appendix 6), which are higher for services than for agricultural products. Subsequently, the increased household income due to additional labour income from Israel generates a higher demand for services than for agricultural products. The unchanged employment level in the manufacturing sector, despite relatively high income elasticities is due to this sector being the most export-oriented in the West Bank (see Appendix 7). Subsequently, it is the most negatively affected by the "Dutch disease" effects of large inflows of labour income from Israel, which are associated with a real appreciation of the domestic currency. As a result, the competitiveness of West Bank exports in the international markets and the output in the manufacturing sector are reduced (see Section 7.4.2). Increasing employment in the construction sector shows that the inflow of workers coming out of unemployment to start working in the domestic market surpasses the outflow of workers leaving the domestic market to be employed in Israel.

Among the previously unemployed moving into employment, 56% start working in Israel, while 44% start in the domestic economy (Table 7.2). While more men move out of unemployment to join the Israeli market, the vast majority of women moving out of unemployment takes a job in the domestic market. This finding stems from a negligible Palestinian female employment in Israel (1% of total female employment) as compared to male employment in Israel (17% of total male employment). With this gender-differentiated pattern of Palestinian employment in Israel, increasing the demand for Palestinian labour in Israel has a substantial effect on female employment as many women move out of unemployment to start working in the domestic economy.

Table 7.2 shows that while most of the low-skilled workers, who move out of unemployment start working in Israel, the majority of high-skilled workers moving out of unemployment starts working in the domestic market. This result is in line with the empirical evidence that the domestic market offers more suitable opportunities for high-skilled workers, while the Israeli market mostly provides low-skill jobs.

Across production sectors, the reduced employment in the domestic manufacturing sector is overcompensated by the movement of labour out of unemployment to start working in Israel. In the other sectors, labour moves out of unemployment to join both the Israeli and domestic markets. In the service sector, the majority of the labour moving out of unemployment starts working in the domestic market, while in the agricultural and construction sectors, the majority is being employed in the Israeli economy. This finding reflects the concentration of the Palestinian employment in Israel in manual sectors, while in the domestic market the service sector is preponderant.

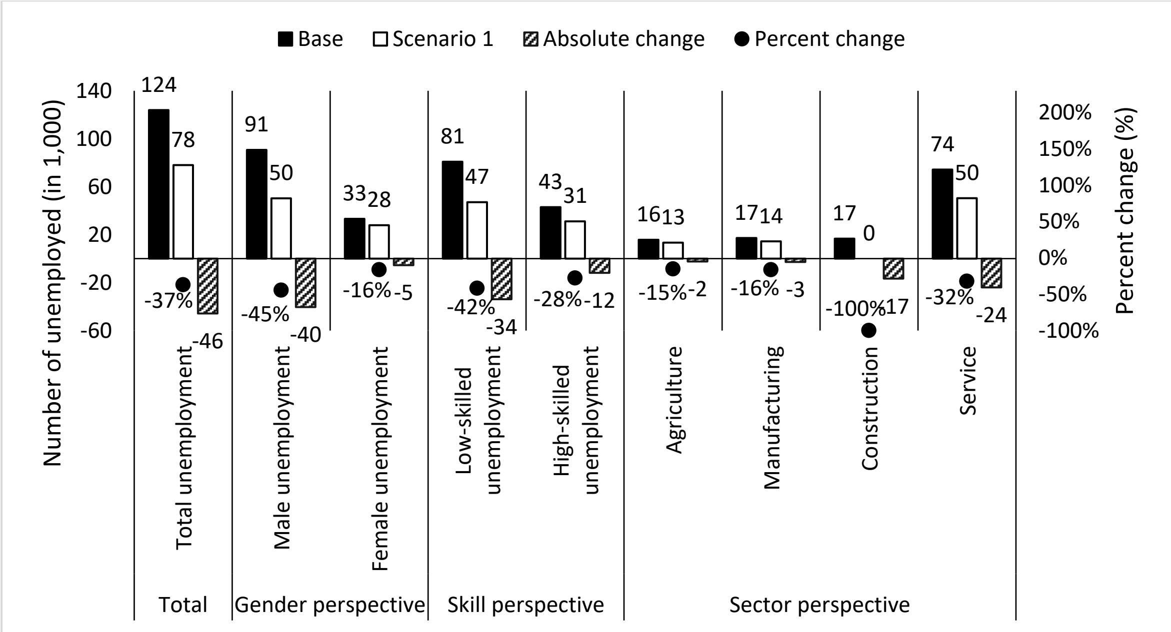
Table 7.2. Changes in employment status among labour categories

	Moving out of unemployment to employment in Israel	Moving out of unemployment to employment in the domestic market	Total moving out of unemployment
Aggregate Labour	25,778 (56%)	20,009 (44%)	45,787 (100%)
Gender perspective			
Male population	25,352 (63%)	15,038 (37%)	40,390 (100%)
Female population	426 (8%)	4,971 (92%)	5,397 (100%)
Skill perspective			
Low-skilled	23,452 (69%)	10,415 (31%)	33,866 (100%)
High-skilled	2,327 (20%)	9,594 (80%)	11,921 (100%)
Sector of employment			
Agriculture	2,250 (95%)	129 (5%)	2,379 (100%)
Manufacturing	2,955 (106%)	-157 (-6%)	2,798 (100%)
Construction	14,315 (86%)	2,346 (14%)	16,661 (100%)
Services	6,258 (26%)	17,691 (74%)	23,949 (100%)

Compared to its initial level, the pool of unemployed labour is reduced by 37% (Figure 7-4). This reflects a drop in the unemployment rate from the initial 17% to 11% of the labour force. Unemployment drops more for the low-skilled (by 43%) than for the high-skilled labour (by 31%). This finding stems from the fact that two thirds of Palestinian workers in Israel are low-skilled. Subsequently, increasing Palestinian labour demand in Israel has a stronger effect on unemployment of the low-skilled workers.

Figure 7-4 also points to unemployment decreasing more for the male population (by 46%) than for the female population (by 19%). This finding has to be related to the fact that the majority of Palestinian labour in Israel is male and that females's participation rate in the labour force is low. Across sectors, unemployment decreases the most in absolute terms for workers in the service sector, because this is the largest sector in the West Bank, including public administration. However, in relative terms, unemployment falls so sharply in the construction sector that full employment is achieved. This finding needs to be put into perspective with the construction sector being the main employer of Palestinians in Israel. In the base, 56% of all Palestinians employed in Israel work in the construction sector.

Figure 7-4. Number of unemployed in the Base & Scenario 1 (in 1,000) as well as change (in 1,000 & %)



Because the pool of unemployed labour in the construction sector is empty, the labour supply curve in the market segments associated with that sector becomes vertical and any further labour demand is fully transmitted into wage increase. Accordingly, wage in the construction sector rises by 10%, while it remains unchanged in the other sectors.

The increase in factor demand for capital in the construction sector is reflected in a 12% price increase. The increased demand for capital in services triggers an increase in the capital price in services by 8%. In agriculture and manufacturing, the relatively smaller extra factor demand inhibits the price effect. Land rent increases by 1% in the agricultural sector.

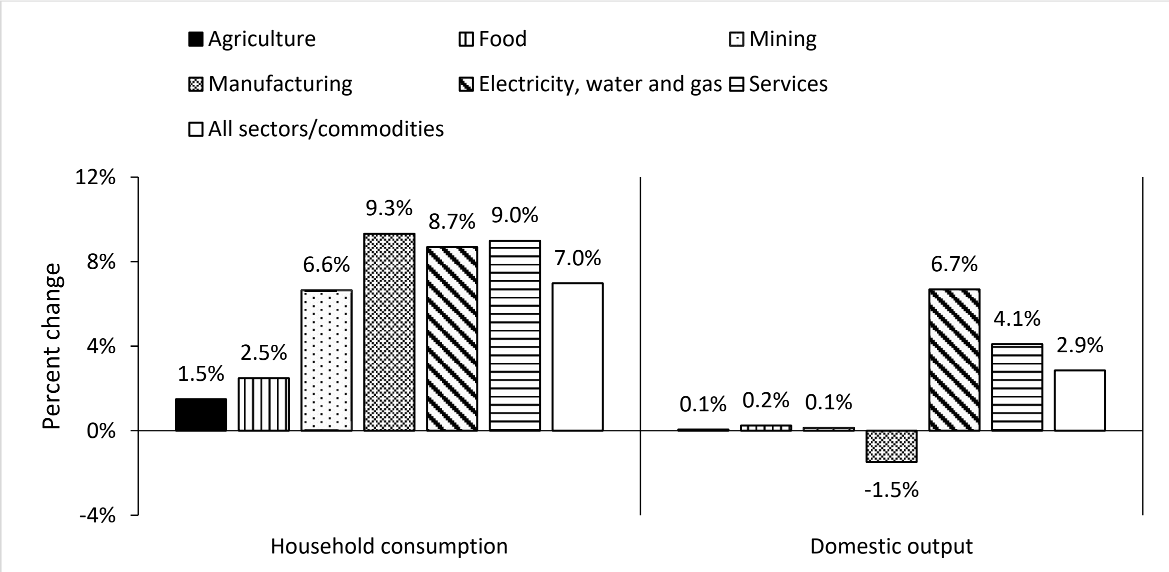
7.4.2. Effects on consumption and output

Driven by the increases in factor prices, the domestic production costs increase and lead consumer prices to increase on average by 1%. Despite the overall increase in consumer prices, total demand in the whole economy increases. Household consumption increases on average by 7%. This increase stems from the additional income earned by new workers in both the domestic and Israeli economies, and it affects all commodity groups. Household consumption increases more for manufacturing products, utilities and services because these commodities have a higher income elasticity of demand.

The increased household demand is met with both increased import demand and domestic production. Domestic output increases in all sectors, except manufacturing. Output reduction in the manufacturing sector is due the "Dutch disease" effects of the Palestinian employment in Israel. The increased employment in Israel and the subsequent large inflow of foreign currency (labour income from Israel) causes a real appreciation of the domestic currency. Consequently, the West Bank export industry is negatively affected, as it loses competitiveness in the international markets. This leads to a decline in domestic output. In the West Bank, the manufacturing sector is the leading export sector, contributing 68% of total export of goods and services in 2011 (PCBS, 2012f). Hence, the manufacturing sector is the most negatively affected by the real appreciation of the domestic currency.

Figure 7-5 shows percent changes in domestic output and household consumption.

Figure 7-5. Change in household consumption and in domestic output (in %)



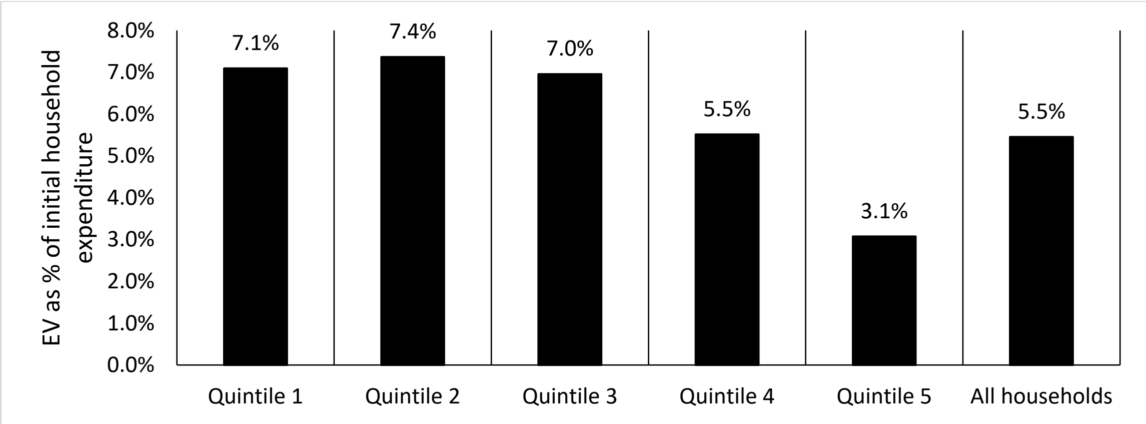
7.4.3. Welfare and macro-level effects

Household income increases in total by 9.4% driven by the increases in factor income, which stem from three sources: i) increased factor prices, ii) increased employment in the domestic market, and iii) factor income earned by additional Palestinians working in Israel. Similarly, household expenditure increases in total by 6.8% with the difference between household income and expenditure being saved or transferred. As a measure of household welfare, the Equivalent Variation[13] as a share of initial household expenditure shows that household net welfare improves on average by 5.5% (Figure 7-6), which is a combination

[13] The Equivalent Variation is defined as the amount of compensation, that must be added (subtracted) to (from) the household's initial income, to leave him as well off as under the combined price and income changes.

of the benefits resulting from a higher income and the burden of a higher consumer prices. Distributional effects at quintile level show that welfare improves more for poor households than for households in the top quintile. This is because the poor households derive in the base a higher share of their income from labour and they have a higher share of their economically active members being employed in Israel than richer households do.

Figure 7-6. Welfare effects (equivalent variation as share of initial household expenditure)



Changes in the macroeconomic aggregates show that the export supply decreases by 4.8% at constant domestic prices, while the import demand increases by 5.9%. The decrease in the real value of export supply is due to the increased cost of production in the domestic economy and the real appreciation of the domestic currency by 2.5%. Subsequently, the Palestinian exports become less competitive in the international markets. Moreover, a higher share of the domestic output is now channelled to the domestic market as the consumer price in the domestic market increases relative to the export price. This finding is in line with Astrup and Dessus (2005) who argued for a trade-off in the Palestinian economy between exporting more labour or more goods. The increase in the real value of import demand stems from the increased household income driving up the overall demand.

Increasing household demand leads absorption in the West Bank to increase by 6.0% in real terms. The combined effects of the various changes in the economy are reflected in a GDP increase by 3.6% at constant domestic prices. This means that an increase in the employment of Palestinians in Israel positively affects the West Bank economy. This finding is consistent with Bulmer (2003), who suggested that in the short-term increased labour income and the positive feedback on aggregate demand lead to welfare gains and positive growth for the West Bank economy. However, in the long-term, the increase in domestic wages reduces incentives for firms to hire more workers, while the real appreciation of the domestic currency reduces the competitiveness of Palestinian products in the international markets and may negatively affect the domestic production.

7.4.4. Results with the alternative assumptions on labour movement and labour force (Scenarios 2, 3 and 4)

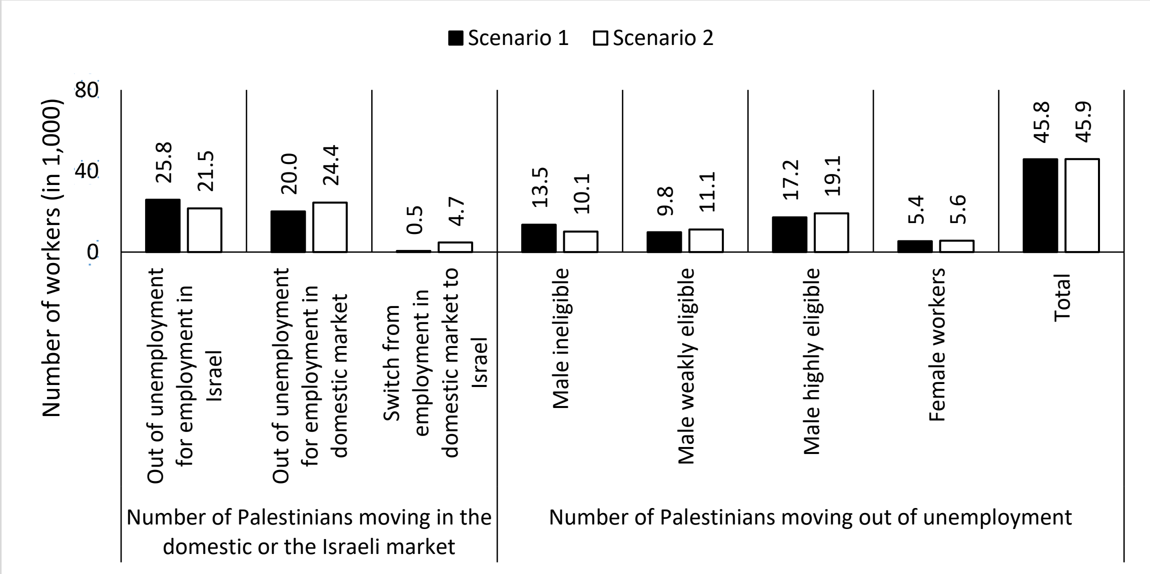
Restricting the movement of additional labour commuting to Israel to Palestinian men who are eligible for a work permit in Israel (scenario 2) draws more than nine times as much workers out of employment in the domestic market as in scenario 1 (Figure 7-7). This is because, in scenario 1, the number of workers who are ineligible for a work permit make 7,219 workers corresponding to 28% of the labour moving out of unemployment to start working in Israel. As the workers in this category are not allowed to move to Israel in scenario 2, all the extra demand for Palestinian labour in Israel falls on the eligible categories where the pool of unemployed labour becomes empty and more workers have to be sourced from the domestic market. Consequently, 4,748 workers are taken out of the domestic market in scenario 2, as compared to 509 workers in scenario 1. Because more workers switch from employment in the domestic market to employment in Israel in scenario 2 than in scenario 1, less workers move out of unemployment to employment in Israel (the extra demand for Palestinian labour in Israel is the same in scenarios 1 and 2).

In other words, the restriction introduced in scenario 2 has the effect of increasing the number of people moving out of unemployment to start working in the domestic market (Figure 7-7). While in scenario 1, 20,009 workers move out of unemployment to start working in the domestic market, in scenario 2 they make 24,395 workers. As expected, the size of the unemployed labour moving into employment (either in Israel or in the domestic market) is larger for categories of eligible Palestinian male workers in scenario 2 as compared to scenario 1. Nevertheless, the shock also has a strong effect on the employment of ineligible Palestinians as many of them move out of unemployment to work exclusively in the domestic market.

Employment opportunities for female workers are concentrated in the domestic market. Because of the increased number of vacancies in the domestic market in scenario 2 compared to scenario 1, the total number of female workers who move out of unemployment is slightly larger in scenario 2 than in scenario1.

At the aggregate level, the net increase in the size of labour moving out of unemployment is similar in scenario 2 and scenario 1.

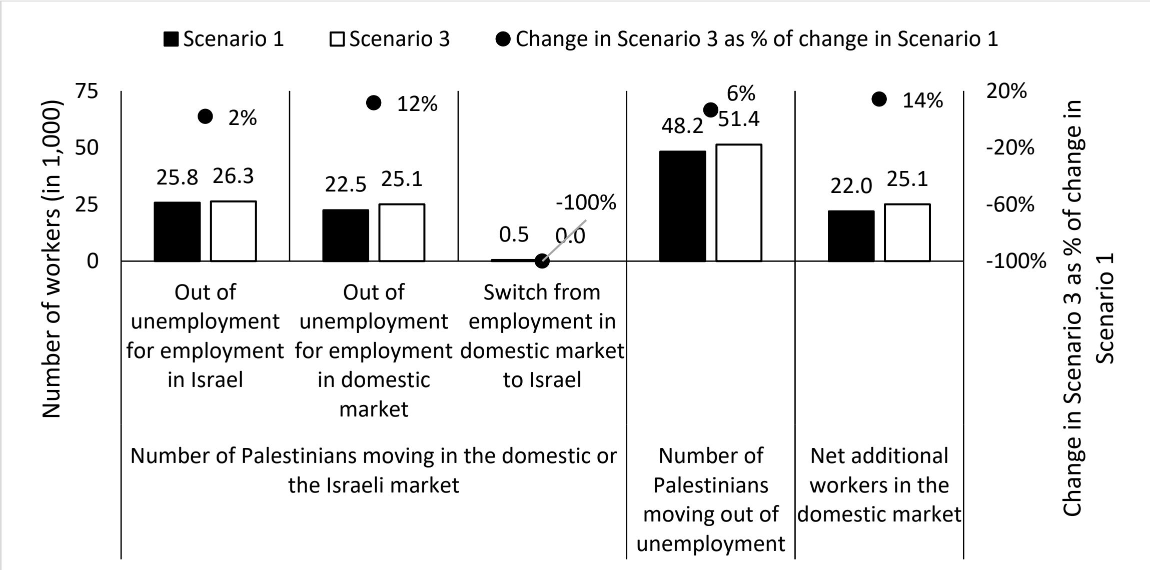
Figure 7-7. Comparison of the results on employment in scenario 2 to scenario 1 (in 1,000 workers)



As more workers leave the domestic market, especially in the construction sector, domestic wages increase more in scenario 2 than in scenario 1. Substitution effects due to more workers, previously unemployed, being employed in the domestic market in scenario 2 ultimately result in similar changes in the macroeconomic aggregates for the two scenarios. Real GDP increases by 3.5% in scenario 2, compared to 3.6% in scenario 1. Although the difference is small, it points that restricting mobility of Palestinian workers to those who are eligible to receive a work permit in Israel reduces the positive effects of easing the Palestinian access to the Israeli market.

Scenario 3 stems from considering that improved access to the Israeli market can stimulate labour force participation in the West Bank, and accordingly increasing the labour supply by 5% which adds 35,893 people to the labour force in the base. This additional labour force can be considered as unemployed, hence increasing the unemployed population by 29%. The results of scenario 3 show that the extra demand for Palestinian labour in Israel is met only with the unemployed labour. Increasing the total supply of labour makes the pool of unemployed labour large enough to meet all the extra demand in Israel. Moreover, the increased pool of unemployed labour makes the horizontal segment of the labour supply curve longer, meaning that employers can employ more labour without needing to increase wages. Accordingly, the number of workers moving out of unemployment to start working in the domestic market is 12% higher in scenario 3 than in scenario 1 (Figure 7-8). The net inflow to the domestic market is 14% higher in scenario 3 than in scenario 1. Consequently, the total number of Palestinians moving out of unemployment in scenario 3 is 6% higher than that in scenario 1 (Figure 7-8). This higher influx is completely attributed to the increase in the size of the labour force, as no worker is switching out of the domestic market.

Figure 7-8. Changes in employment in scenario 3 as compared to scenario 1 (1,000 workers & %)



Due to the increased pool of unemployed labour, firms have the opportunity to employ more labour without increasing wages. Subsequently, the average wage per worker in the domestic economy increases only by 0.1% in scenario 3, as compared to 2.5% in scenario 1. The net increase in employment is ultimately translated into increases in the household income and consumption. Real GDP increases by 3.9% compared to 3.6% in scenario 1. This finding indicates that a potential increase in the labour force participation will magnify the effects of easing access of Palestinian labour to Israel.

Results of scenario 4 with a reduced Palestinian labour demand in Israel are overall mirroring those of scenario 1. The pool of unemployed labour increases by 38.1%, compared to a decrease by 37.0% in scenario 1. The construction sector is the most affected, as the number of unemployed labour in that sector more than doubles. This result highlights the inability of the domestic West Bank market to absorb the labour no longer employed in Israel in the short-term. The loss in factor income from Israel triggers a reduction in household income by 9.2% in real terms. The reduced consumption drives import demand and domestic output down by 5.6% and 2.9% in real terms respectively. As the domestic demand for domestically produced commodities decreases and the domestic currency experiences a real depreciation, export supply increases by 5.4% at constant domestic prices. Household welfare decreases by 5.4% on average and the economy shrinks by 4.0% in real terms.

7.5. Conclusions and policy implications

7.5.1. General conclusions and areas for future model developments

Employment in Israel has been a distinct feature of the Palestinian labour force for several decades. In recent years, the restrictions on both the number and characteristics of Palestinians eligible for a work permit in Israel have altered the flow of Palestinians commuting to Israel for work with significant implications for unemployment and economic growth in the Palestinian territories. This chapter assesses the short-term effects of changes in the number and composition of Palestinian workers in Israel on the West Bank economy. A modified version of the STAGE-2 model is used and calibrated to a version of the SAM that includes the essential economic sectors in the West Bank that would potentially be affected by a cross-border movement of workers.

The results show that a return of Palestinian employment in Israel to its *pre-intifada* level, as simulated in scenario 1, improves household welfare by 5.5% on average and triggers a GDP growth by 3.6%. This finding shows that, in the short-term, the increased labour income from Israel has a positive effect on aggregate demand and is beneficial for the West Bank economy. However, in the long-term, the increase in domestic wages reduces incentives for firms to hire more workers, while the real appreciation of the domestic currency reduces the competitiveness of Palestinian products in the international markets and may negatively affect the domestic production. In order to capture the long-term effects of the extra labour demand in Israel on the West Bank economy different specifications would need to be incorporated in the model. First, in the long-term, factors should be allowed to be mobile across market segments. Second, factors should be considered at full employment by including the possibility of employment in activities beyond the production boundary. Third, total factor supply within the production boundary should be flexible.

Factor mobility between market segments in the long-term is supported by the finding that wages increase by 10% in the construction sector, while remaining unchanged in the other sectors. Similarly, the price of capital increases by 12% and 8% in the construction and service sectors respectively, while remaining unchanged in the agricultural and manufacturing sectors. Whereas these findings are consistent with the short-term time horizon of the analysis, in the long-term the increase in factor prices in the construction and service sectors will lead to a movement of factors into these sectors and factor prices in all sectors will converge. Allowing cross-segment mobility in the model requires the definition of pairs of segments between which mobility is allowed and the specification for each pair of a response elasticity. Then, the mobility function embedded in the model can be activated by relative changes in factor prices. This approach has the advantage of recording the flows of factors in physical units (Flaig, 2014).

In order to represent the economy at full employment and include the activities beyond the production boundary, a suitable specification to use is the labour-leisure trade-off, as shown in Chapter 6. The labour-leisure trade-off extends the production boundary by adding to the market activities the production of leisure by households using their own labour as input. Labour ownership by households is considered at full time endowment, including both the working and non-working time. Household utility is also defined at full consumption by accounting for household consumption of leisure. Subsequently, households maximise their utility by consuming a basket of commodities and leisure subject to budget and time constraints. The decision to work instead of consuming leisure is associated with an opportunity cost. Hence, this approach allows households to respond to exogenous shocks by allocating more or less labour to market activities.

The representation of the labour market conditions with a surplus labour specification has the drawback that the unemployed labour has no opportunity cost for the employer and it has no opportunity cost outside the production boundary. Additionally, the functional form of the labour supply curve with fixed real wages first matches the extra demand of labour in Israel with the unemployed labour. While this mechanism is consistent with the empirical evidence that in the short-term, unemployment in the West Bank and labour access to the Israeli market are highly correlated, assuming that workers are drawn out of the domestic employment only when the pool of unemployed labour is empty may understate the effect of the shock on domestic employment. Consequently, the finding that only 2% of the extra labour demand in Israel is met with workers previously employed in the domestic West Bank market can be considered as the lower bound estimate of the outcome of the shock in the real world.

To have a sense of the magnitude of the effects if more workers switch out of the domestic market, the same shock as in scenario 1 is run assuming a vertical (inelastic) labour supply curve. The results show a sharper increase in wages, higher production costs and ultimately a decline in the domestic output by 2.2%. Because of the additional inflow of labour income from Israel, households experience a welfare gain by 3.1% on average. However, the economy as a whole is negatively affected, with GDP shrinking by 2.0%. These results can be considered as the upper bound estimate since the new assumption draws all the extra labour demand in Israel from the domestic market. In conclusion, alternative approaches to depict unemployment and control the previous status of Palestinian workers who join the Israeli market need to be explored by future research.

The results show that in the domestic market, the loss of workers who switch to employment in Israel is overcompensated by the entry of workers moving out of unemployment. The model implicitly assumes that the new entrants have the same productivity as those already in employment. Accordingly, the model does not account for experience accumulation and hence the qualitative loss for the domestic production due to experienced workers switching to the Israeli market. Similarly, for labour movement between the domestic sectors, and from unemployment to the domestic market, assuming that the new comers are as productive as those who are already in employment may overestimate the effects of labour mobility. Therefore, another area for model improvement is to account for the reallocation costs and productivity losses associated with labour movement in the short-term. A first approach is that of Flaig (2014) who defines productivity to be partly worker-specific and partly sector-specific. A second approach by Lofgren and Cicowiez (2017) considers workers who are already in a sector to be more efficient and to earn higher wages than the new comers.

Finally, the results indicate that household income increases on average by 9.4% with net welfare gains for all household groups. These results hold at the aggregate household level. However, the model is inadequate to draw deeper insights about distributional effects at representative household group level. Following the standard approach of distributing factor income based on the initial shares, the model assumes that the additional labour income from Israel is distributed to households who in the base year have members working in Israel. However, in the real world, it is likely that a substantial share of the new jobs in Israel will be taken by workers whose households of origin initially have no worker employed in Israel. Hence, the composition of income at the level of individual household groups may change compared to the base year. To address this issue, endogenous factor income distribution as suggested by Aragie *et al.* (2017) should be considered.

7.5.2. Policy implications for the Palestinian National Authority

The analysis shows that, in the Palestinian context, increasing the demand of Palestinian labour in Israel has beneficial effects on the West Bank economy. Unemployment decreases substantially, household welfare improves and the economy in general expands as captured by the real GDP increase in scenario 1. The results of scenario 2 shows that restricting Palestinian access to Israel only to workers who are eligible for work permits in Israel reduces the positive effects of easing the Palestinian access to the Israeli market very slightly. Moreover, the results of scenario 4, which reduces the number of Palestinians working in Israel, corroborate the inability of the West Bank domestic market to absorb in the short-term the returning workers previously employed in Israel.

Seen the limited development options in the West Bank, and its relative isolation due to the Israeli control over external borders and the Israeli restrictions in place, it is interesting for the Palestinian National Authority to seek more labour movement to Israel. However, as highlighted by the results of scenarios 1 and 4, exporting more labour to Israel comes at the cost of exporting less goods that could have earned foreign currency and reduced the trade deficit. Moreover, more Palestinian employment in Israel drives the reservation wage up and reduces incentives to invest in the domestic market.

To mitigate those negative effects, the Palestinian National Authority (PNA) could levy a tax on Palestinians employed in Israel. Such a tax would generate revenue for the PNA that could be used to invest in the domestic market to support domestic enterprises in rebuilding their eroded productive capacity and upgrading their production technologies in order to generate more employment opportunities in the domestic market. The tax would also reduce the reservation wage in the domestic market caused by the high wages received in Israel and would stimulate more employment and investment in the domestic market. The tax, by reducing the income for Palestinian workers in Israel, will reduce the attractiveness of employment in Israel for workers already employed in the domestic market. Ultimately, it will reduce the heavy dependence on Israeli labour markets, while building employment opportunities in the domestic market, such that unemployment could be reduced and household income will not be negatively affected by the loss of labour income from Israel.

8

LONG-TERM EFFECTS OF PALESTINIAN EMPLOYMENT IN ISRAEL ON THE WEST BANK ECONOMY[14]

[14] Parts of this chapter have been published as a conference paper: Agbahey, J., Siddig, K., Grethe, H., 2018. Labour leisure trade-off meets a mobility function to model cross-border movements of labour between Palestine and Israel. In: 21st Annual Conference on Global Economic Analysis. Cartagena: Global Trade Analysis Project (GTAP), p.27.

Chapter 8 Long-term effects of Palestinian employment in Israel on the West Bank economy

8.1. Introduction

The movement of persons to supply services abroad has been a sensitive issue in international trade negotiations for a long time (Stephenson and Hufbauer, 2010). While tariff rates were significantly reduced through bilateral and multilateral trade agreements in the last five decades, still restrictions of various kinds limit the mobility of labour and impede trade in services (Orefice, 2017). These restrictions mostly target the low and semi-skilled workers and include quantitative regulations (quotas of workers), rules for obtaining work permits, and inefficiencies in processing the applications for work permits (Cattaneo *et al.*, 2010).

The restrictions on labour mobility are often tightened when a political conflict arises between the trade partners. Political conflicts affect international labour mobility in two ways. First, workers and employers across the borders depend on continuity and stability to maintain long-term employment links. The expectation or outbreak of conflicts destroys those links (Long, 2008). Second, international labour flows give states a set of instruments to signal their resolve in a political conflict (Heilmann, 2016).

While both the sanctioning and sanctioned parties are negatively affected, the capacity of the economy to absorb the effects depends on the relative importance of the link for each partner. Small countries, for which international remittances account for a substantial part of the Gross National Income (GNI), are particularly vulnerable (Di Giovanni *et al.*, 2015). A thorough literature review of how conflicts affect trade and inter-state economic relations is provided in Section 1.5.1 of this thesis and the specific case of how the Palestinian-Israeli conflict affects the Palestinian economy is reviewed in Chapter 4 of this thesis.

In Chapter 7, the economy-wide effects of a return of the Palestinian employment in Israel to its *pre-intifada* level of 1999 – which is seen by many observers and both Palestinian and Israeli officials as a desirable outcome – are investigated using a short-term perspective. Accordingly, the labour markets were assumed rigid with limited labour mobility and persistent involuntary unemployment. The supply and demand of labour were determined given fixed real wages, as long as the pool of unemployment was not emptied. In order to assess the long-term effects of increased Palestinian employment in Israel, further development of the model specifications are needed to incorporate a cross-segment factor mobility and enable wages to adjust to the labour market conditions.

Building on the discussion about how to depict imperfect labour mobility in CGE models (see Section 3.3.1 of Chapter 3), a labour mobility function is introduced here as this model specification keeps the market clearing equation transparent. Moreover, this specification fits the long-term time horizon of the analysis as it assumes new workers to be as productive as workers already in employment. Based on the insights from Chapter 6, the labour market conditions are represented with a labour-leisure trade-off assumption, as this model specification is consistent with standard economic theories and allows transfers of labour across the production boundary, while accounting explicitly for welfare changes within and outside the boundary.

The next Section, 8.2, presents the data and the model used in the chapter. Section 8.3 describes the simulation implemented. Section 8.4 analyses the main results, while Section 8.5 draws on the main conclusions and policy implications.

8.2. Methods

8.2.1. Data

The database used in this chapter is an aggregated version of the detailed SAM described in Chapter 5. The aggregation process is identical to the one in Chapter 6 and the only difference is the inclusion of leisure. To implement the labour-leisure trade-off, changes to the database are required in order to incorporate leisure activities and commodities. Each representative household is paired with a unique activity that uses the household's own time as input to produce leisure that is consumed only by that household. The factor ownership matrix also has to be extended to account for the labour each household uses to produce leisure, in addition to the labour that is supplied to the market.

Leisure in this chapter is equivalent to the non-working time, including the time available to the household members who are unemployed within the SNA boundary. In practical terms, one employed person within the SNA boundary in the original database corresponds to eight working hours and a person unemployed within the SNA boundary counts for eight non-working hours. Next, every person has twelve active hours per day after excluding the time required for vital functions such as sleeping. Accordingly, the leisure time at disposal for every person, whether employed within the SNA boundary or not, amounts to four non-working hours. Subsequently, every person employed within the SNA boundary has eight working hours and four non-working hours, while every person who is unemployed within the SNA boundary has in total twelve non-working hours.

Table 8.1 reports the employment data in the base year.

Table 8.1. Employment data in the base year (unit = 8 hours)

Employment within the SNA boundary	Domestic market activities	519,148
	Foreign market activities	74,814
Employment outside the SNA boundary	Leisure activities	482,819

As the social accounting matrix records transaction values, the leisure produced by a factor f is valued at the market price of that factor. Hence, the transaction values in the SAM for leisure production and consumption equal the leisure time for each labour group multiplied by its market wage. Since the amount of leisure produced by each household is the same that is consumed by that household, the system is closed and there is no leakage.

8.2.2. Model description

The model used in this chapter is a modified version of the STAGE-2 model by McDonald and Thierfelder (2013). Some specifications introduced to the STAGE-2 model are identical to the one in Chapter 6: the multi-trade partner and the extension of the production module. The elasticities used in the trade block and in the production module are reported in Appendix 4 and Appendix 5 respectively.

A labour mobility function is also incorporated in the model used in this chapter. The mobility function is governed by a wage ratio ($WMOBRATIO$) as defined in equation [8.1]

$$\boldsymbol{WMOBRATIO_{f,fp,insw}} = \frac{\sum_a (WF_{fp} * WFDIST_{fp,a} * FD_{fp,a})}{\sum_a FD_{fp,a}} \Bigg/ \frac{\sum_a (WF_{fmig} * WFDIST_{f,a} * FD_{f,a})}{\sum_a FD_{f,a}} \qquad [8.1]$$

where FD is the demand for factor f in activity a, WF the average wage rate for factor f and $WFDIST$ an activity specific factor “efficiency” parameter capturing differences in the observed productivities of factor f in different activities.

A change in relative wages activates the mobility function as defined in Equation [8.2].

$$\boldsymbol{FSIM_{f,fp,insw}} = \boldsymbol{FSI0_{insw,f}} * \left(\frac{WMOBRATIO_{f,fp,insw}}{WMOBRATIO0_{f,fp,insw}}\right)^{etamig_{f,fp,insw}} \qquad [8.2]$$

where $FSIM$ is the variable recording the number of workers moving from f to fp, $FSI0$ is the initial pool of labour f supplied by institution insw, $WMOBRATIO$ is the ratio between wages for f and fp after the shock and $WMOBRATIO0$ is the wage ratio in the base year. Hence, when the wage for factor f increases relative to that of factor fp, the ratio $WMOBRATIO$ diverges from $WMOBRATIO0$ and mobility from f to fp takes place. The intensity of the mobility is governed by a response elasticity ($etamig$). This elasticity is defined for each pair of market segments and captures the influence of structural and behavioural features such as transaction costs, efficiency of factor markets and preferences to stay with the current occupation on labour mobility.

Equation [8.3] avoids the creation of additional factors by ensuring that for each unit of factor moved from one segment only one unit of factor is created in the paired segment. This equation also determines the number of workers who stay in their market segment. The new pool of factor f supplied by each institution is defined by equation [8.4].

$$\boldsymbol{FSIM_{f,fp,insw} = FSI_{insw,f} - \sum_{fp} FSIM_{f,fp,insw}} \qquad [8.3]$$

$$\boldsymbol{FSI_{insw,fmig} = \sum_{fp} FSIM_{f,fp,insw}} \qquad [8.4]$$

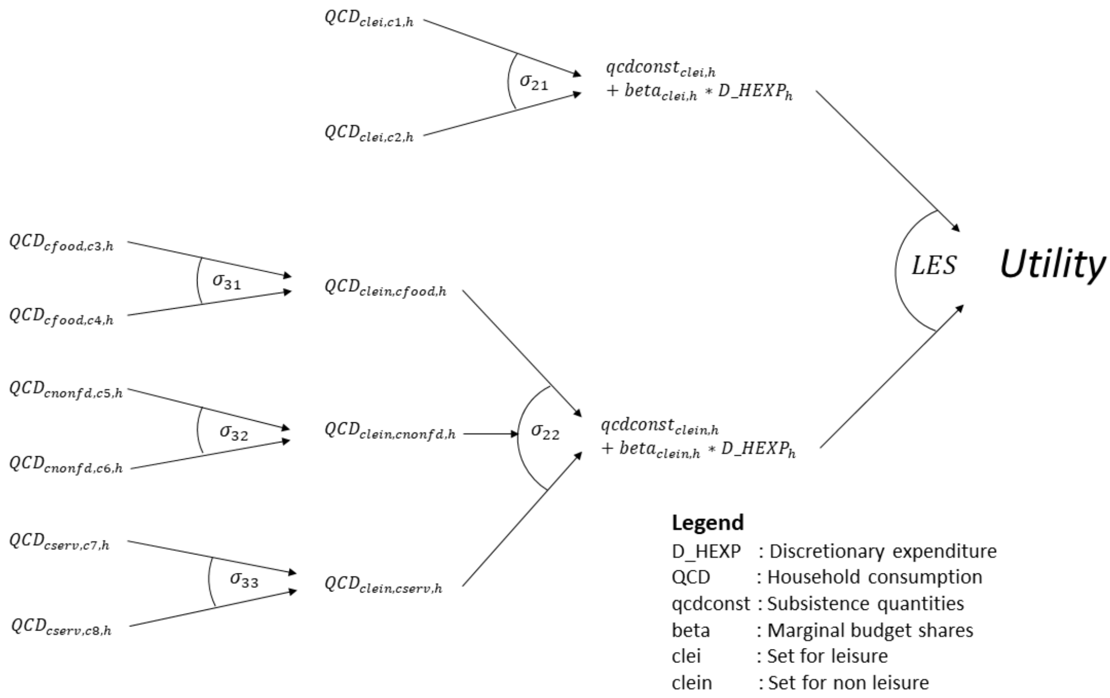
Allowing labour to be mobile across market segments implies that the standard assumption of factor income being distributed to households in fixed proportions is no longer valid. Accordingly, the matrix of fixed share coefficients controlling the functional distribution of income is replaced by a matrix of variables that tracks changes in the supply of labour in each segment, hence making the labour income distribution endogenous.

Incorporating the labour-leisure trade-off in the STAGE-2 model does not require changes to the behavioural relationships of the model on the production side, since the opportunity cost of labour used in the production of leisure is the marginal wage income forgone. However, on the consumption side, the utility function of the STAGE-2 model is modified to differentiate household preferences for leisure and non-leisure commodities. Instead of the single-stage Linear Expenditure System (LES), derived from a Stone-Geary utility function, a three-stage nested utility function is used combining LES and CES functions. The benefits of introducing a multi-stage nesting structure are twofold. First, it allows the use of different functional forms at each stage of the nest and the combination of their respective advantages to replicate the household behaviour. Second, it provides a greater flexibility in assigning different elasticities of substitution at different stages of the nest.

For this chapter, an LES function is used at the top of the nesting structure with two broad groups of commodities: leisure and non-leisure commodity groups entering the nest. At the intermediate level, a CES function is used to differentiate the individual components that make up each of the two broad groups of commodities. The non-leisure commodity group is made of three aggregate commodities: food, non-food goods and services. At the lowest level, each of these three aggregates are composed of individual commodities.

Figure 8-1 illustrates the nesting structure.

Figure 8-1. Nesting structure of the utility function



Source: Own illustration

Having an LES function at the top of the nesting structure allows the differentiation between subsistence and discretionary consumption. This functionality is especially relevant in developing regions like the West Bank, where some households are very poor. Defining the subsistence levels of consumption over broad groups of commodities is more reasonable than having subsistence consumption for individual commodities as implied by the single-stage LES structure (Aragie *et al.*, 2017). The choice of leisure and non-leisure commodities as the two broad groups of commodities entering the LES nest is based on empirical findings that leisure and non-leisure commodities are complements even in developing countries (Alderman and Sahn, 1993). Subsequently, the choice of an LES function which implies that the commodities in the nest are gross complements (De Boer and Missaglia, 2006) is well suited to nest these two broad commodity groups.

At the intermediate level, a CES function is used to combine food, non-food and services to form the broad group of non-leisure commodities. The choice of a CES function at this level of the nesting structure is motivated by the empirical finding that food, non-food and services are mostly substitutes (Halbrendt *et al.*, 1994; Huang, 1993). Therefore, their optimal combination is determined by their relative prices, through a first order condition. Finally, at the lowest level, individual commodities that make up the three groups of food, non-food goods and services are also considered as substitutes. Subsequently, their optimal combination is determined by their relative prices. The substitution at the lowest nest is considered to be higher than that at the intermediate level of the nesting structure.

8.2.3. Macroeconomic closures

The reality of the West Bank being a small player in the international markets is depicted with the small country assumption. The nominal exchange rate (defined in domestic per world unit) is fixed to reflect the reality that Palestine does not have its own currency and uses the Israeli Shekel over which it has no influence. The current account balance is also fixed to avoid any changes in borrowing from foreign funds, while keeping all the welfare effects in the solution period. The consumer price index is fixed and serves as the numeraire, meaning that transfers and wages are in real terms.

The model is investment driven, as investments in the Palestinian economy are largely exogenous. The level of investment is defined in terms of final demand because economic growth in the West Bank is likely to be correlated with a lower tension with Israel providing a secured environment that will attract more foreign investments (Naqib, 2003). To keep the balance between savings and investments, household and enterprise savings rates vary equiproportionately. The government savings are fixed, while direct tax and value added tax rates adjust multiplicatively to maintain the balance. Government consumption is a fixed share of the final demand, such that when final demand increases as the economy expands, government consumption follows suit. This assumption stems the tendency of the public sector in the West Bank to expand quickly (UNCTAD, 2006).

8.2.4. Factor closures

All factors are fully employed. Additionally, capital and land are fully mobile across activities while labour is mobile within a market segment across all activities, but only mobile across segments that are controlled with a positive elasticity of mobility. The choice of pairs of market segments and the direction of labour mobility between them follows the Kuznets' structural transformation process (Herrendorf *et al.*, 2014). Accordingly, labour can move from the agricultural sector to the manufacturing and construction sectors; from the manufacturing sector to the construction and tertiary sectors and from the construction sector to the tertiary sector. The assumption of one-way movement between the sectors follows the rationale that a labour movement to sectors at the top of the structural transformation process is associated with changes in living conditions. Subsequently, even with stronger positive changes in wages in the sectors at the bottom of the structural process (e.g. agricultural sector), a backward movement of labour my not take place, as the workers enjoy the city life and do not see future prospects in the rural areas.

8.2.5. Factor market clearing equations

The initial factor market clearing equation is modified to reflect the employment of Palestinian labour in domestic market activities, in the Israeli market and in the production of leisure, as shown in Equation [8.5]

$$\boldsymbol{FS_f} = \sum_{\boldsymbol{alein}} \boldsymbol{FD_{f,a}} + \sum_{\boldsymbol{w}} \boldsymbol{fd\_w_{f,w}} + \sum_{\boldsymbol{insw}} \boldsymbol{FSIE_{insw,f}} \qquad \forall \boldsymbol{alein_a} \ \boldsymbol{and} \ \boldsymbol{f_{ff}} \qquad [8.5]$$

Where FS_f is the total supply of labour. Factor demand $FD_{f,a}$ is only aggregated over the set $alein$, which refers to the domestic market activities. The parameter $fd\_w_{f,w}$ captures the demand for Palestinian labour in Israel. As a parameter which is set exogenously, it ensures that the model takes up the envisaged shock of increased Palestinian employment in Israel. This mechanism reflects the empirical evidence that the employment of Palestinians in Israel is demand-driven. The wage premium in Israel ensures that any increased demand is met, while the permit system and the closures enforce any drop in demand. $FSIE_{insw,f}$ is the amount of factor f supplied by institution insw for the production of leisure. The demand of labour in the production of leisure is defined in the equation [8.6], where the mapping (map_hh_alei) pairs leisure activities $alei$ with households (hh), while the set $alei$ refers to leisure activities.

$$\boldsymbol{FSIE_{insw,f}} = \sum_{\boldsymbol{a\$map\_hh\_alei(insw,a)}} \boldsymbol{FD_{f,a}} \qquad \forall \boldsymbol{alei_a} \ \boldsymbol{and} \ \boldsymbol{f_{ff}} \qquad [8.6]$$

8.3. Simulation

After assuring that the model replicates the original data that represents the economy in 2011, which is called “base” scenario, a counterfactual scenario of a return to the *pre-intifada* level of Palestinian employment in Israel is introduced. The shock implemented here is the same as described in Section 6.4 of Chapter 6.

Table 8.2 summarises the number of Palestinian workers in Israel in the base year in physical units and in the scenario as percentage change compared to the base. Factor income from Israel for each labour group is increased in the same proportions as their numbers.

Table 8.2. Number of Palestinian workers in Israel in the base (physical units) and in the scenario (% change as compared to the base)

	Base (unit = 8 hours)	Scenario (%)
Low-skilled ineligible males	17,364	35.7%
Low-skilled weakly eligible males	19,065	35.7%
Low-skilled highly eligible males	29,128	35.7%
Low-skilled females	1,162	35.7%
High-skilled ineligible males	3,123	35.7%
High-skilled weakly eligible males	1,254	35.7%
High-skilled highly eligible males	2,559	35.7%
High-skilled females	32	35.7%
Total	73,687	35.7%

8.4. Results and analyses

This section starts with a discussion of the effects of the shock on the factors markets, followed by changes in the commodity markets (market output and consumption). Afterwards, it discusses the macroeconomic and welfare effects. The section ends with a discussion on how sensitive the results are to changes in key parameter values and changes in the nesting structure of the utility function. In this section, due to space contingency, results are displayed for aggregated categories.

8.4.1. Effects on the factor markets

The extra demand of 26,287 Palestinian workers in Israel is met with 20,092 workers previously employed within the SNA boundary and switching from employment in the domestic market to employment in Israel and 6,195 additional workers supplied by households out of the non-market activities. In other words, about three-fourths of the new Palestinian workers in Israel were previously employed in the domestic market activities while one-fourth was previously occupied in the non-market activities. This finding is consistent with the expectation that the supply of labour to the market activities is almost perfectly stable in the long-term (Boeters and Savard, 2011). Empirically, Gronau and Hamermesh (2006) showed that household leisure time barely responds to 25-40% increases in wages.

This finding is to be contrasted with the short-term effects of the same shock assessed in Chapter 7, which showed that the majority of the Palestinian workers who start working in Israel were in the previous period not employed in the market activities. Those results are consistent with the empirical evidence of a close correlation between employment in Israel and the unemployment rate in the West Bank in the short-term. In fact, the volatility of employment in Israel combined with the low capacity of the domestic economy to absorb in the short-term large numbers of workers displaced from the Israeli economy by the conflict creates a pool of involuntary unemployment, which supports the close correlation between employment in Israel and the unemployment rate in the West Bank. However, in the long-term, as labour is either employed in the market activities or self-employed in the non-market activities, there is no involuntary unemployment and the supply of labour by households to the market activities is quite stable. Consequently, the correlation between employment in Israel and unemployment in the market activities in the West Bank is less strong in the long-term. Instead of reducing substantially their leisure time to supply more labour to the market activities, households rather shift their members who are employed in the domestic market activities to Israel, where wages are higher.

The higher wages offered in Israel do not only displace workers out of employment in the domestic market, they also raise real wages by 6.1% in the West Bank. Domestic wages increase relatively more for the low-skilled workers (by 7.3%) than for the high-skilled workers (by 4.8%). This result is consistent with the empirical findings of Mansour (2010) that employment in Israel has stronger effects on wages for the low-skilled workers in the domestic West Bank market. Increased demand for Palestinian labour in Israel improves employment opportunities for Palestinian workers, so that to retain workers in the domestic market, employers have to raise wages. Because the availability of employment in Israel is concentrated in low-skill sectors, domestic wages for low-skilled workers experience a stronger increase.

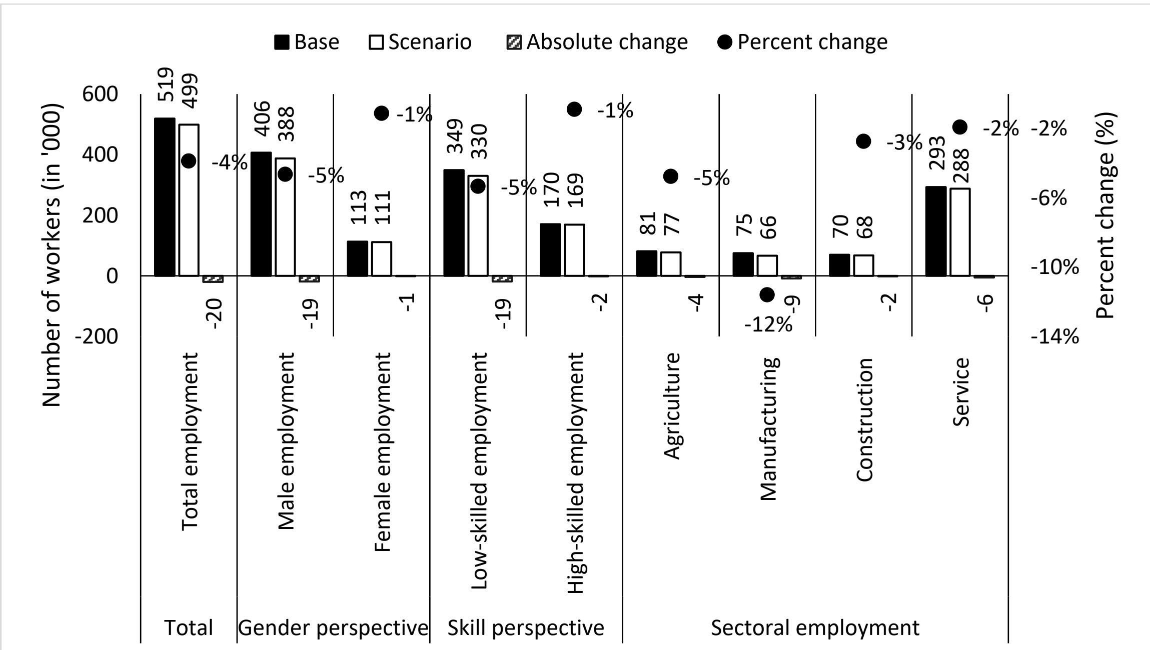
The implementation of the mobility function allows workers to move across the market segments. Table 8.1 points that workers move from the agricultural and manufacturing sectors into the construction sector. This finding is related to the composition of Palestinian employment in Israel, which is concentrated in the manual sectors. About 56% of all Palestinians working in Israel are employed in the construction sector in the base. The experiment by preserving the initial composition of Palestinian employment in Israel imposes a stronger shock on the labour employed in the construction sector. Therefore, wages increase more rapidly in the construction sector than in other sectors. Consequently, provided the possibility for labour to be mobile upon changes in relative wages, there is a labour movement from the other sectors into the construction sector.

Table 8.3. Labour movement results (number of workers)

	Moving from		Moving to	
	Agriculture	Manufacturing	Construction	Services
Low-skilled ineligible males	657	1,882	2,539	0
Low-skilled weakly eligible males	187	1,367	1,554	0
Low-skilled highly eligible males	1,263	2,171	3,434	0
Low-skilled females	0	339	0	339
High-skilled ineligible males	207	333	540	0
High-skilled weakly eligible males	37	148	185	0
High-skilled highly eligible males	89	258	347	0
High-skilled females	0	93	0	93
Total	2,440	6,592	8,600	432

Figure 8-2 compares employment in the domestic market activities after the shock to the base. In total, the pool of employment in the domestic market decreases by 4%. From the gender and skill perspectives, males and low-skilled workers are the most negatively affected. This finding can be put into perspective with the evidence that Palestinian employment in Israel mostly comprises male workers who are low-skilled. From the sectoral perspective, the manufacturing sector experiences the most important drop in both absolute and relative terms.

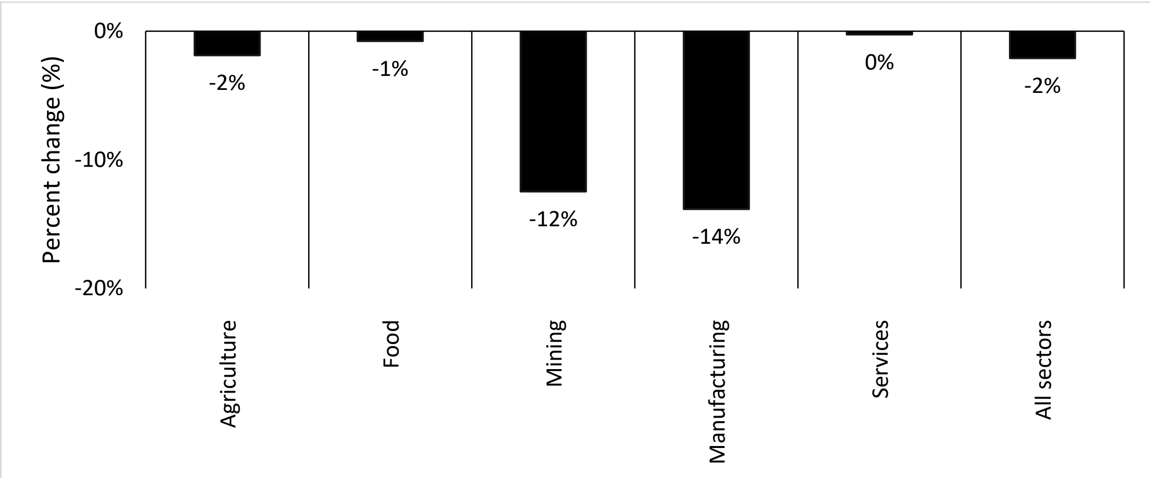
Figure 8-2. Levels of employment in domestic market activities (in 1,000 workers) and change in scenario compared to the base (in 1,000 workers and in %)



8.4.2. Effects on the domestic market output

The increase in factor prices drives production costs up by 3.1% on average. Due to the increased costs and the limited availability of labour, after many workers switched away from the domestic market activities, the domestic market output experiences a drop by 2.1% on average. The sectors experiencing the highest drop are the mining and manufacturing sectors (Figure 8-3).

Figure 8-3. Change in domestic output by sector (in %)



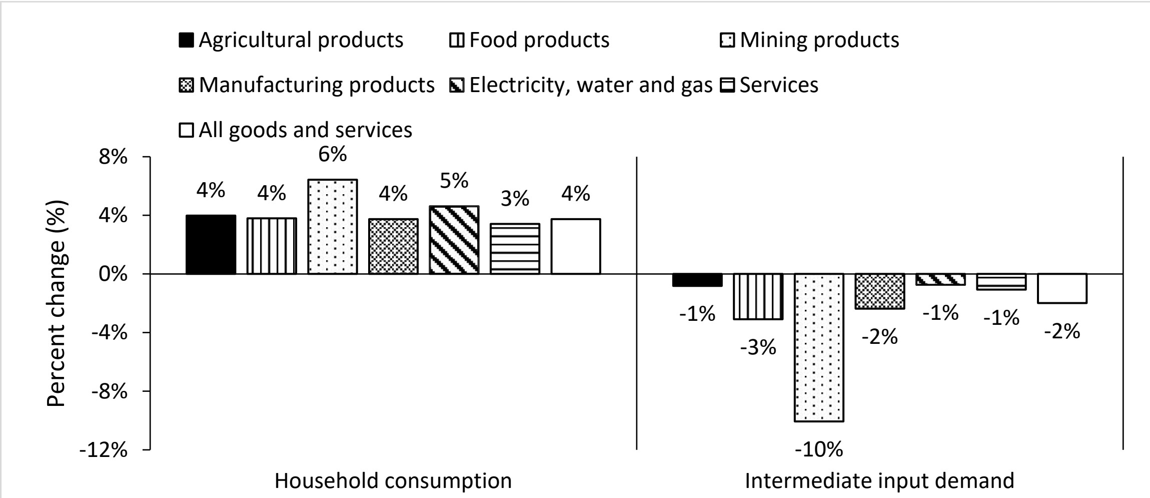
The substantial drop in domestic output in the manufacturing and mining sectors is consistent with the reduced demand for labour in those sectors as shown in Figure 8-2. This finding stems from manufacturing being the main export sector in the West Bank, contributing to 68% of Palestinian exports of goods and services in 2011 (PCBS, 2012f). With the increased demand for Palestinian labour in Israel, the inflow of labour income from Israel also increases. This large inflow of foreign currency in the West Bank economy causes "Dutch disease" effects through a real appreciation of the domestic currency. Subsequently, the West Bank exports loose competitiveness in the international markets. The manufacturing sector, as the most export-oriented sector in the West Bank, is the most negatively affected.

The manufacturing sector is itself dominated by the stone and marble industry, which accounts for about 25% of Palestinian overall industrial revenues (Abu Hanieh *et al.*, 2014). The negative effects felt in that industry lead to spillover effects into the mining sector which is dominated by the quarrying stone and marble. This explains that the mining sector is the second most negatively affected sector.

8.4.3. Effects on demand

The increase in the domestic production costs is transmitted to the consumer prices which increase on average by 2.2%. Subsequently, the demand for goods and services as intermediate inputs decreases on average by 2.0%. By contrast, household consumption for goods and services increases on average by 3.7% (Figure 8-4). Despite the increase in prices, households are able to increase their demand for goods and services because their income increases on average by 5.8%. This increase in household income stems from the extra labour income from Israel and the raise in domestic wages. This income increase overcompensates the loss in income due to the exit of workers from employment in the domestic market activities.

Figure 8-4. Change in household and intermediate demand for goods and services (in %)



The reduction in the demand for intermediate inputs stems not only from the increased prices of goods and services used as intermediate inputs, but also from the slowdown in the domestic production which necessitates fewer inputs. The demand for mining products as inputs drops the most (by 10.1%). This finding corroborates the forward linkages between the mining and manufacturing sectors with the mining products – especially stone and marble – used as inputs in the leading export industry of finished stone and marble which is the most negatively affected by the real appreciation of the domestic currency.

Across quintile groups, the consumption of goods and services increases for all household groups. Consumption increases relatively more for the poorer households than for the richer households (Figure 8-5). This finding stems from the fact that poor households derive in the base a higher share of their income from labour and have a higher share of employment in Israel. Subsequently, increasing Palestinian employment in Israel has a stronger positive effect on poor household income and hence on their consumption.

Figure 8-5. Change in household consumption of goods, services and leisure compared to base (in %)

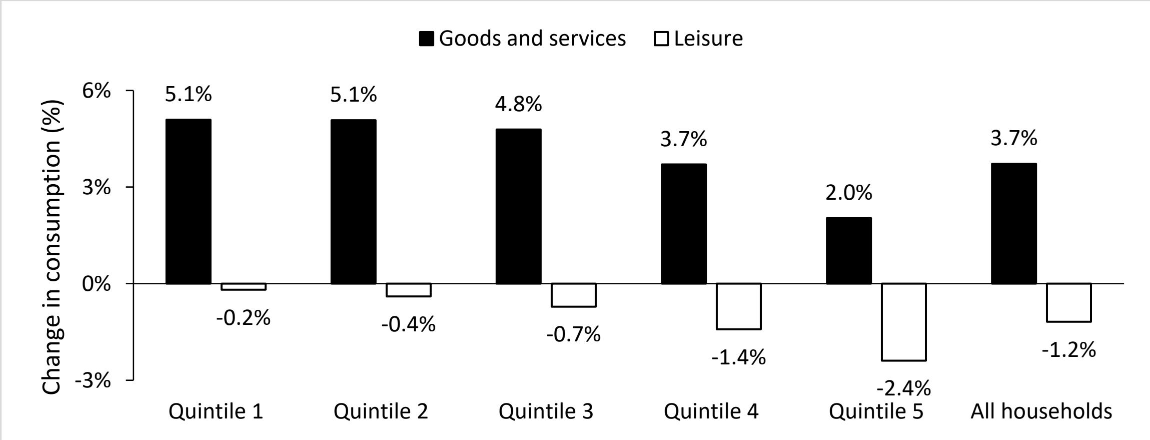


Figure 8-5 also shows that the consumption of leisure decreases for all household groups. It decreases on average by 1.2%. This is the net of substitution and income effects affecting household decisions. The income effects imply that households are inclined to consume more leisure because of the additional income from Israel since leisure is a “normal good” (Alderman and Sahn, 1993; Njegovan, 2006). However, as wages increase by 6.1%, so does the opportunity cost of leisure. The substitution effects make household to shift labour out of the production of leisure to the market activities. As the net effect is a reduction in the consumption of leisure, it can be concluded that the substitution effects were stronger than the income effects.

A comparative analysis shows that the rich households reduced more their consumption of leisure than the poor households (Figure 8-5). Hence, the effect of increasing Palestinian employment in Israel on rich households is a reduction in their leisure time while poor households mostly shift their labour from the West Bank market to Israel and do not reduce much their leisure time. This finding stems from the fact that poor households have a higher endowment in low-skilled labour in the base than rich households. As the availability of employment in Israel is concentrated in low-skill sectors, it reduces the incentive to work inside the SNA production boundary by increasing the price of non-traded commodities of which the most “non-traded” is leisure.

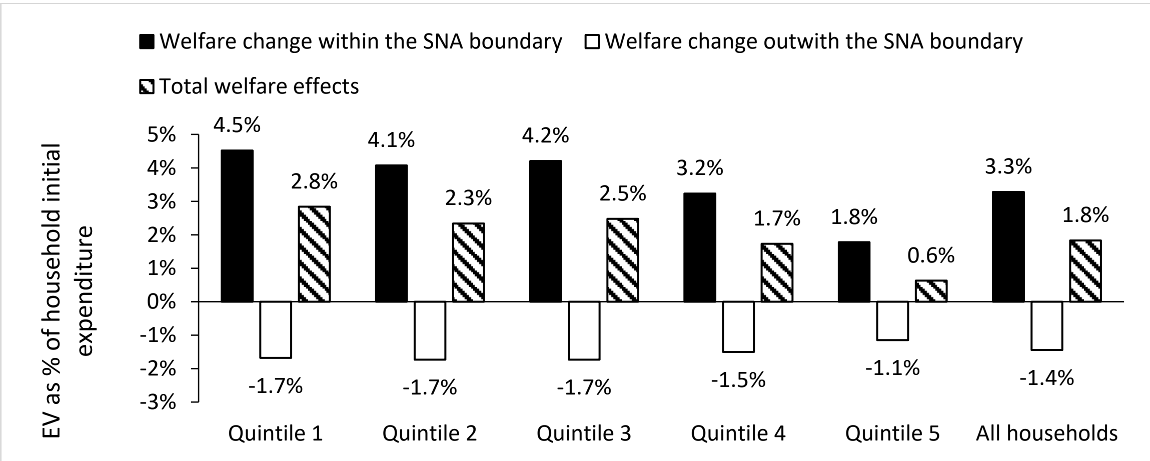
8.4.4. Welfare analysis

The results show that while household income increases by 5.8%, household expenditure increases by 3.1% on average with the difference between income and expenditure made up by savings and transfers. The increase in household expenditure stems from both the increase in consumer prices of goods and services and the increased household consumption.

As a measure of household welfare, the Slutsky Equivalent Variation[15] as a share of the initial household expenditure shows net welfare improvements on average for all household groups (Figure 8-6). The welfare generated within the SNA boundary increases by 3.3% on average. However, the welfare outside the production boundary decreases for all household groups, as their leisure consumption is reduced. It decreases by 1.4% on average. The total welfare effect is nonetheless positive for all household groups.

The distributional effects at quintile level show that welfare improves more for the poor households than for households in the top quintile. This finding stems from the fact that poor households have a higher share of employment in Israel in the base and derive a higher share of their income from labour. These distributional effects show that increased employment in Israel can contribute to a more equal income distribution in the West Bank.

Figure 8-6. Welfare results (equivalent variation as share of initial household expenditure)



8.4.5. Macroeconomic aggregates

The changes in the macroeconomic aggregates show that aggregate demand (absorption) of goods and services in the West Bank economy increases by 2.6% in real terms, mostly driven by the increase in household consumption. This increased household consumption is not only met by increasing import demand, which rises by 2.3% in real terms, but also by increasing the domestic supply to the domestic market at the expense of export supply. Export supply from the West Bank drops by 16.3% due to the "Dutch disease" effects of the large inflows of foreign currency which are associated with the increased employment

[15] The Equivalent Variation is the amount of compensation, that must be added (subtracted) to (from) the household's initial income, to leave him as well off as under the combined price and income changes.

in Israel. Subsequently, the domestic currency experiences a real appreciation which negatively affects the domestic export industry. In addition, a rise in prices for products sold domestically contributes to lower exports.

The aggregate domestic output decreases by 2.1% in real terms, due to the increased production costs and a reduced availability of labour in the domestic West Bank market. Ultimately, the economy shrinks and GDP declines by 1.1%. This finding illustrates the trade-off associated with the employment of Palestinians in Israel for the West Bank in the long-term. While households benefit from an increased income and achieve welfare gains, the domestic economy shrinks as employment opportunities in Israel reduce incentives to work and invest in the domestic market.

8.4.6. Sensitivity analysis

In the absence of reliable data series to estimate country-specific values of key parameters used in the model, a sensitivity analysis is needed to check for the robustness of the simulation results. This section is articulated around two poles: i) the sensitivity of the simulation results to key elasticities, and ii) the sensitivity of the results to a different nesting structure for household utility.

Testing for the sensitivity of the results to key elasticities

Testing the sensitivity of the results to selected parameters is performed by varying their values independently. The key parameters that are considered are the following: the marginal utility of income (so-called Frisch parameter), the income elasticities of demand for leisure relative to the demand for goods and services, the CES elasticities in the utility function and the labour mobility elasticity.

For the sake of keeping the outcomes of the sensitivity analysis clear and concise, Table 8.4 presents the values assumed for the parameters in the initial model (in bold) and the shifts operated in the sensitivity analysis as well as the findings of the robustness checks for selected macroeconomic results. For the labour mobility and the CES elasticities, the shifts operated consisted in halving and/or doubling the values of the parameters in the initial model. For the income elasticities of demand, the check consisted in assuming that households have a higher income elasticity for leisure relative to goods and services, which is the opposite of the assumption incorporated in the initial model. For the Frisch parameter, the subsistence share of household expenditure was increased and decreased to the extent that is possible to avoid negative subsistence consumption, and the corresponding values of the Frisch parameters were computed.

The findings of the sensitivity analysis show that the model is marginally sensitive to changes in the values of the parameters of concern. Changing the labour mobility elasticity affects the movements of labour across market segments but hardly changes the welfare outcomes and the macroeconomic aggregates. Doubling and/or halving the substitution elasticities along the nesting structure of the utility function mainly affects the composition of household consumption but leaves the aggregate volume of consumption unchanged as compared to the initial model results. Shifting the values of the Frisch parameter and the income elasticity of demand affects the number of additional workers supplied by households to the market activities by less than +/- 10% compared to the initial model results.

In conclusion, the overall macroeconomic picture is not very sensitive to variations in key parameter values. No qualitative change is observed in the direction of the effects of increased Palestinian employment in Israel on the West Bank economy. Subsequently, the results can be seen as robust.

Table 8.4. Values of parameters in the initial model and in the robustness checks, and key results of the sensitivity analysis

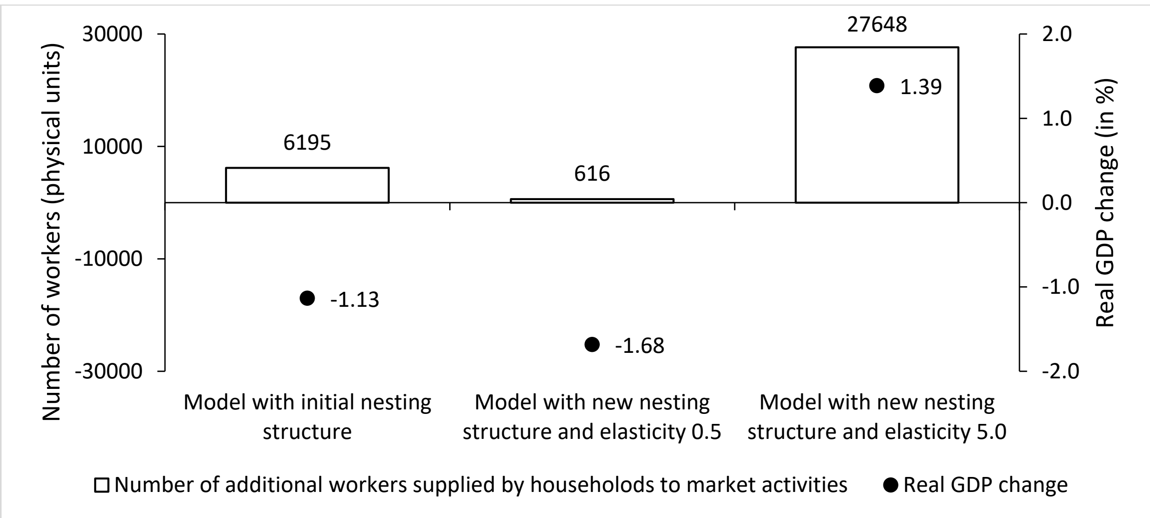
	Labour mobility elasticity			CES elasticity along the utility function (see Figure 8-1)					Income elasticity of demand		Frisch elasticities		
	e=1.0	**e=2.0**	e=4.0	$\boldsymbol{\sigma_{22}}$**=0.1**	σ_{22}=0.2	σ_{3i}=0.075	$\boldsymbol{\sigma_{3i}}$**=0.15**	σ_{3i}=0.3	$\boldsymbol{\delta_{clei}}$ **(0.3) <** $\boldsymbol{\delta_{clein}}$ **(0.5)**	δ_{clei} (0.5) > δ_{clein} (0.3)	ρ_{Q1} =-1.52 ... ρ_{Q5}=-1.16	$\boldsymbol{\rho_{Q1}}$**=-1.60 ...** $\boldsymbol{\rho_{Q5}}$**=-1.20**	ρ_{Q1}=-1.69 ... ρ_{Q5}=-1.26
Additional labour supplied by households (physical quantities)	-6329	**-6195**	-6093	**-6195**	-6125	-6273	**-6195**	-6047	**-6195**	-5640	-6640	**-6195**	-5738
Household consumption of goods and services (%)	3.80	**3.73**	3.68	**3.73**	3.73	3.75	**3.73**	3.69	**3.73**	3.69	3.78	**3.73**	3.68
Net welfare excluding leisure (EV as % of initial household expenditure)	3.35	**3.28**	3.23	**3.28**	3.28	3.30	**3.28**	3.24	**3.28**	3.24	3.32	**3.28**	3.24
Net welfare including leisure (EV as % of initial household expenditure)	1.87	**1.83**	1.81	**1.83**	1.84	1.84	**1.83**	1.82	**1.83**	1.83	1.83	**1.83**	1.83
Real output (%)	-2.07	**-2.11**	-2.14	**-2.11**	-2.11	-2.11	**-2.11**	-2.11	**-2.11**	-2.14	-2.05	**-2.11**	-2.16
Real GDP (%)	-1.12	**-1.13**	-1.15	**-1.13**	-1.15	-1.12	**-1.13**	-1.17	**-1.13**	-1.17	-1.08	-1.13	-1.19

Testing for the sensitivity of the results to a different nested utility function

The nested utility function used in the initial model assumed that leisure and non-leisure commodities (goods and services) are the two broad groups of commodities on which households decide their subsistence consumption. Having these two groups in the LES nest also implies that they are gross complements in generating utility as supported by the empirical evidence provided by Alderman and Sahn (1993). However, there is a large number of alternative nesting structures that can be applied. Assuming for instance that households decide on their subsistence consumption over food and non-food commodities and that leisure is actually a substitute to other non-food commodities makes a substantial difference. A visual representation of such a nesting structure is provided in Appendix 8. A particularity of this assumption is that leisure enters a CES nest and therefore there is a greater flexibility in controlling the substitution between leisure and other non-food commodities.

For the sensitivity analysis, such a nesting structure is used. The results are very sensitive to the value of the CES elasticity between leisure and other non-food commodities (Figure 8-7). Using a small elasticity (0.5) has the effect of making households to supply only 616 more workers to the market activities. Real GDP drops substantially by 1.68%. However, assigning a very large elasticity (5.0) has strong effects on the labour supplied by households and on the economy in general. About 27,649 workers are supplied by households to the market activities. This means that all the extra Palestinian labour demand in Israel (26,287 workers) is met with labour previously unemployed within the SNA boundary and some 1,362 workers start employment in the domestic market. Subsequently, the domestic output increases in real terms and real GDP increases by 1.39%.

Figure 8-7. Change in number of workers (physical units) and in real GDP (%) in the models with initial and new nesting structures



Given this sensitivity of the results to the elasticity of substitution between leisure and other non-food commodities, if one chooses to use such a nesting structure, the choice of the elasticity should be properly documented.

8.5. Conclusions and policy implications

This chapter combines the labour-leisure trade-off and a factor mobility function to assess the long-term effects of an increased demand for Palestinian labour in Israel. The model also features a nested utility function combining the benefits of linear expenditure systems and constant elasticity of substitution functions by depicting the household behaviour with different functional forms at each stage of the nest.

The analysis shows that an increased Palestinian labour demand in Israel affects the amount of labour supplied by households. About one-fourth of the Palestinians who start working in Israel were in the previous period occupied in the non-market activities. In other words, they were used by households for the production of leisure. The remaining three-fourths were already employed within the SNA boundary in the previous period and are now shifted from the domestic market activities to the Israeli market. The reduced employment in the domestic market activities in the long-term negatively affects the domestic production. Ultimately, the economy shrinks and real GDP decreases by 1.13%.

These results confirm the findings of other studies (Astrup and Dessus, 2005; UNCTAD, 2016) that an increased Palestinian employment in Israel hurts the domestic economy in the long-term. Increased employment in Israel does not only displace workers from employment in the domestic market activities, it also raises wages in real terms in the domestic market. Subsequently, domestic employers have less incentives to invest and hire more labour. Moreover, the large inflow of labour income from Israel has "Dutch disease" effects through a real appreciation of the domestic currency. Consequently, the Palestinian exports loose competitiveness in the international markets and this puts a burden on the domestic production.

The increased labour income from Israel increases household income by 5.8% on average and enables households to increase consumption of goods and services. Ultimately, Palestinian households enjoy welfare gains. While the gains generated by the consumption of goods and services from the market are substantial, the net welfare is reduced by losses linked to the consumption of leisure. The ability to separate the welfare effects generated within the SNA boundary from those outside the boundary is one of the benefits of using the labour-leisure trade-off framework. This explicitly accounts for welfare changes taking place outside the SNA production boundary.

The results show that in the long-term, the supply of labour to the market by households is relatively inelastic. Moreover, the "Dutch disease" effects of large inflows of labour income from Israel reduce incentives to work inside the SNA production boundary by increasing the price of non-traded commodities of which the most "non-traded" is leisure. Using the labour-leisure trade-off framework proved suitable to capture this mechanism. By contrast, in the short-term, the empirical evidence supports a close correlation between employment in Israel and unemployment in the West Bank labour market (Bulmer, 2003; Etkes, 2012). In fact, the small capacity of the domestic economy does not provide sufficient employment opportunities to absorb in the short-term all the workers previously employed in Israel who are laid off from employment in Israel during the conflict. Hence, there is a pool of involuntary unemployment, ready to take employment opportunities at current wage rates. A suitable framework to model this short-term empirical evidence is the labour surplus assumption used in Chapter 7.

In Chapter 7, the same increase in Palestinian labour demand in Israel as simulated in this chapter is mostly met with labour previously unemployed in the market activities. Additionally, employment in the domestic market activities is increased as the additional household income derived from employment in Israel increases demand, which stimulates the domestic production. Subsequently, in the short-term, not only households derive welfare gains but the economy as a whole benefits from the improved labour access to the Israeli markets with real GDP increasing by 3.6%. Contrasting the long and short-term effects of the shock shows that the time dimension matters in assessing the effects of increased Palestinian employment in Israel.

Using a mobility function to captures labour movements across market segments shows that labour mainly moves from the agricultural and manufacturing sectors into the construction sector which is the most affected sector by the shock since most Palestinians employed in Israel work in the construction sector. Adopting the labour mobility function distributes the effects of the shock more evenly across sectors, as otherwise wages would have surged in the construction sector without triggering a movement from the other sectors.

The sensitivity analysis performed shows that the results are robust and are hardly affected by a systematic change in the values of the following parameters: Frisch parameter, income demand elasticities, substitution elasticities along the utility function and the labour mobility elasticity. However, the results are sensitive to changes in the nesting structure of the utility function, especially if one considers leisure to be a substitute to goods and services in consumption. In this case, and with high substitution elasticities, the share of labour moving out of the non-market activities may substantially increase.

This chapter makes three contributions. First, the method that is used allows accounting for the household's full time endowment comprising work and leisure time. This reflects the trade-off between allocating time for leisure or for work in the market activities. The welfare generated from the consumption of leisure is explicitly accounted for with leisure entering the household utility function. In addition to the labour-leisure trade-off, this chapter assumes an imperfect labour mobility which is a core aspect of structural changes in the economy. Labour heterogeneity is explicitly recognised and a mobility function is used to control labour movements across market segments. Combining the labour-leisure trade-off and the mobility function allows the debate of the long-term effects of increased Palestinian employment in Israel to be addressed within a theoretical framework capable of generating robust empirical results.

Second, this chapter contributes to the ongoing debate on the costs of Israeli occupation of the Palestinian territories and the potential effects of a negotiated solution to the conflict. The results show that an increased Palestinian labour demand in Israel has in the long-term negative effects on the West Bank economy but positive welfare effects for the Palestinian households, especially the poor ones. This finding demonstrates both the contribution of Palestinian employment in Israel to a more equal income distribution in the West Bank and its deteriorating effect on the Palestinian economic growth by bidding up wages, reallocating labour away from the tradable activities and reducing the competitiveness of the Palestinian export sector.

Third, the simulation results have important policy implications. Seen the limited development options for Palestine, it may be interesting for the Palestinian National Authority (PNA) to seek increased Palestinian employment in Israel in order to improve welfare of Palestinian households. However, the negative effects of this on the domestic economy should be mitigated. To do so, the PNA could levy a tax on Palestinians employed in Israel. This tax will generate additional revenue for the PNA. With this revenue, incentives could be given to domestic employers to invest and restore their competitiveness in the international markets. The tax would also reduce the attractiveness of employment in Israel, keep some workers in the domestic market activities and limit the structural dependence on the Israeli labour market. Ultimately, the Palestinian economy may want to shift from a labour-export to a goods-export development strategy.

9

PALESTINIAN TRADE POLICY IN A FINAL SETTLEMENT[16]

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Chapter 9 Palestinian trade policy in a final settlement

9.1. Introduction

The assessment of different trade options in a future Palestinian state has mostly been addressed with a descriptive analysis in the existing literature. Arnon and Bamya (2007), Vaggi and Baroud (2005), and Elmusa and El-Jaafari (1995) recommended a free trade agreement between Palestine and Israel on the premise that clear borders are needed between the two economies but that Palestine would benefit from a free access to the Israeli market. The authors also argue that Palestine should independently set taxes on trade with countries other than Israel. Another group of studies (e.g. Kanafani, 1996; Abed, 1996) favoured a better implementation of the customs union with Israel, arguing that the absence of customs borders and a proper working customs union with Israel would secure a smoother flow of the Palestinian trade. A third group of studies (e.g. Fischer *et al.*, 2001) suggested that the future Palestinian economy should adopt a liberal and non-discriminatory trade regime.

Besides these descriptive studies, a few estimates of the impact of different trade regimes have been produced for Palestine. Schiff (2002) used a cost-benefit analysis to compare different trade options. While such analysis offers first insights into the effects of different trade regimes, it misses the multiplier and economy-wide effects that trade policy may generate. Other estimates were produced by UNCTAD (2009) using a macro-econometric model. Such a model is suitable to analyse the outcomes of policy change at the macroeconomic level, it lacks the micro-optimisation dimension that can be found in a CGE model. The first CGE model to analyse trade policy changes in Palestine was developed by Astrup and Dessus (2001, 2005). However, the model had some rigidities, such as the imbedded assumption of the economy being at full employment, which sits at odds with the observed level of unemployment in Palestine. Some of these rigidities were addressed by Missaglia and Valensisi (2014), who extended the previous model by incorporating several of the specificities of the Palestinian macroeconomic context. Nevertheless, the new model – similar to the previous – does not incorporate a detailed production structure as well as differentiated labour and household accounts to enable a detailed analysis of the effects of different trade options.

Most of the previous studies also ignored the physical and economic separation of Gaza from the West Bank since the beginning of the second Palestinian uprising in 2000. This chapter examines the effects of two alternative trade regimes on the West Bank economy as compared to the current customs union with Israel. For this purpose, a modified version of the STAGE-2 model is calibrated to the detailed West Bank SAM compiled in this thesis.

The next Section, 9.2, provides an overview of the current trade pattern in the West Bank. Section 9.3 presents the specifications of the model used and the features of the database that are relevant for the analysis conducted in this chapter. Section 9.4 describes the trade options that are simulated. In Section 9.5 the key results of the simulations are discussed. Finally, Section 9.6 draws the main conclusions.

9.2. Overview of the trade conditions in the West Bank

This section provides an overview of the current trade regime in the West Bank. A detailed description of the evolution of trade policies in the West Bank is provided in Chapter 4.

The trade regime in the West Bank is governed by the Protocol on Economic Relations signed by the government of Israel and the Palestine Liberation Organisation in 1994. The protocol was initially intended to cover a transitory period of five years after which the Palestinian National Authority (PNA) would gradually be empowered with the full control over trade and economic policies and eventually the provision of clear borders for a sovereign Palestinian state. Against its vision to create favourable conditions for the development of the Palestinian economy, the protocol did not entail any structural break (Roy, 2002). Instead, it formalised the one-sided customs union prevailing between Israel and the Palestinian territories since 1972. While the protocol recognises that the two parties might have different interests and priorities, it only offered the Palestinians a limited policy space. The customs union is not bilaterally coordinated. The trade regime in the Palestinian territories continues to follow the Israeli customs and the PNA can only set tariffs on a few imported goods and within certain limits (Vaggi and Baroud, 2005).

The Protocol provisions grant the PNA the possibility to enter into bilateral trade agreements with other countries. However, the implementation of the agreements signed by the PNA is undermined by the lack of Palestinian control over its external borders (World Bank, 2008). The only working trade agreements in Palestine are those signed by Israel with other countries and which benefit Palestine because of being in a customs union with Israel. Most of these agreements involve tariff-rate-quotas. However, the quotas in Palestine are not determined by the PNA alone. They are rather negotiated within a joint committee with the Israeli Trade Authority. As of 2012, Palestinian quotas for imports from countries having trade agreements with Israel (and Palestine) were set at 20% of the Israeli pledges (MAS, PCBS, PMA, 2013).

The limited access of Palestine to global markets promotes trade diversion and a high dependency on Israel (Astrup and Dessus, 2005). In 2011 Israel accounted for 70% of total Palestinian imports and 86% of its exports (PCBS, 2012a). As the value of imports is considerably larger than the value of exports, the Palestinian economy carries a huge trade deficit representing 44% of its GDP (PCBS, 2014). The trade deficit with Israel alone makes up two-thirds of the total. A consequence of this unbalanced trade pattern is the transformation of the Palestinian economy into a captive market for Israeli products. Palestinian production for the domestic market was undercut by the economies of scale realised by the technologically advanced Israeli manufacturers (Naqib, 2003). Moreover, the development of a productive capacity in Palestine was held back by restrictions and regulations imposed on Palestinian entrepreneurs by the Israeli administration (Botta, 2010).

The Protocol also suffers from a selective application of its basic provisions (Elkhafif et al., 2014). Against the presupposed free movement of labour and goods, political and military reality imposed a different path. Following a series of terrorist attacks in 1993, Israel started implementing a closure policy, which consists of roadblocks and curfews restricting the movement of goods, services and people between Israel and the Palestinian territories, between the West Bank and the Gaza Strip, and within the West Bank (Eltalla and Hens, 2009). Closures were declared on short notice and for different lengths of time, hence disrupting the Palestinian trade flows, increasing transaction costs and creating more uncertainty in the Palestinian economy (Ihle and Rubin, 2013).

While Israel is the main entry point for most Palestinian imports from the rest of the world, often taxes on indirect import from other countries via Israel are not transferred to the PNA. This leads to significant fiscal losses for the PNA (Fjeldstad and al-Zagha, 2004). The Protocol also failed to provide the Palestinian Monetary Authority the power to issue an independent currency. The absence of its own currency deprives the PNA of seigniorage revenues and removes a policy tool that could be used to respond to the economy's specific needs and to external shocks (IMF, 2013).

Whereas Israeli policies and the asymmetric relationships enshrined in the Oslo agreements and Paris Protocol were major factors behind the deterioration of the economic environment in Palestine, the PNA also played a damaging role. The establishment of import monopolies, and the failure to establish an appropriate legal and regulatory framework environment to attract investments exacerbated the sluggish economic conditions (Roy, 2001).

In conclusion, the determinants of the Palestinian low trade performance are multiple. The protocol on economic relations with Israel – projected to develop an export-oriented Palestinian economy that would generate domestic jobs and lessen dependence on Israel – failed to bear the desired fruit (Astrup and Dessus, 2001). Although it was designed for a temporary period of five years, it has been in place for more than two decades and still governs the Palestinian trade relations with Israel and with the rest of the world. Under the current situation, the Protocol is outdated and no longer addresses the challenges faced by the Palestinian economy (UNCTAD, 2016). In this view, a final political settlement – to generate a more balanced agreement for long-term healthier economic relations between Israel and a sovereign Palestinian state – may contribute to improving the situation. Among scholars and observers, there is a wide consensus that the economic integration with no internal border largely failed (Arnon and Weinblatt, 2001). Consequently, the final settlement needs to entail the creation of economic borders and grant the Palestinians full control over trade and monetary policies (Malul *et al.,* 2008). After exiting the customs union with Israel, Palestinian authorities could choose among several trade options. Conceding that the choice of a future trade regime for Palestine would not be determined by economic criteria alone and that political choices as well as thorny issues – such as the right of return and the status of Jerusalem – are likely to affect the range of possible options, this study provides a quantitative assessment of the potential impact of different trade options from a purely economic perspective in order to inform the debate.

9.3. Methods

9.3.1. Data

The SAM used in this chapter is an aggregated version of the detailed SAM described in Chapter 5. It comprises 161 accounts, and incorporates a multiple product activity setup with 38 commodity groups produced by 28 activities. It features seven foreign regions based on the major trade agreements in which Palestine is a member. These include the customs union with Israel, the preferential trade agreements with the EU-28, EFTA[17], USA, Turkey, Jordan and the Greater Arab Free Trade Area (GAFTA). The other countries – with the majority not having a specific trade agreement with Palestine – are classified under the umbrella "rest of the world". The SAM includes 34 tax accounts among which are seven import tariffs and seven export taxes associated with each trade partner. This detailed disaggregation of trade partners and import/export tax accounts allows for a thorough assessment of different trade options of the West Bank economy.

Table 9.1 presents the trade shares in the base period (2011) for the seven regions involved in trade with the West Bank. It highlights the predominance of Israel for both West Bank imports and exports. Given these uneven trade shares, the model used is modified to apply a differentiated treatment to regions that account for large and small trade shares of a commodity import and export (see Section 9.3.2). This treatment recognises the influence

[17] EU-28 refers to the 28 members of the European political and economic Union, while EFTA stands for the European Free Trade Association formed by Iceland, Liechtenstein, Norway, and Switzerland.

of geographical distance and economic size on trade, as well as the existence of niche markets and consumption preferences, which make small trade partners maintain a relatively small trade share after a policy change.

Table 9.1. Shares of West Bank imports and exports by trade partner in the base (in %)

	Import	Export
Israel	71.3	80.6
USA	0.8	1.4
EU-28 + EFTA	8.3	9.5
Turkey	3.7	0.1
Jordan	5.4	2.9
GAFTA zone	3.8	2.5
Rest of the world	6.6	2.9

Source: West Bank SAM

Table 9.2 presents the tariff rates for different commodity groups (for presentation purposes, all commodities in the SAM are grouped into four categories). Due to the current customs envelope, imports from Israel are free of tariff, with the only exception being petroleum products, which are actually indirect imports since Israel is not an oil producer. According to an agreement between the PNA and Israel, tariffs collected by Israel on petroleum products that are re-exported to Palestine are transferred to the PNA (UNCTAD, 2012). Due to the preferential trade agreements, tariff rates on imports from the USA, Europe, Turkey, Jordan and the GAFTA zone are substantially lower than on imports from the rest of the world, which are subject to the Most-favoured-nation (MFN) rates.

A system of tariff-rate-quotas is in place in Palestine, mostly on agricultural and food products. The tariff rates displayed in Table 9.2 are derived from tariff revenue per product and the import values. With most agricultural and food products being imported within the quotas (MAS, PCBS, PMA, 2013), the computed tariff rates for these two categories of commodity can be considered close to the in-quota rates. Therefore, these rates do not fully reflect the level of protection of the domestic food and agricultural sectors in Palestine, as higher rates typically apply for out-of-quota imports. Details on in-quota and out-of-quota tariff rates – by commodity group and trade partner – in the West Bank are provided in Appendix 9. Appendix 10 displays the levels of import quotas in the West Bank for agricultural and food products per commodity group and trade partner. Section 9.3.2 describes how tariff-rate-quotas are modelled in this chapter.

Table 9.2. Tariff rates (in %) by commodity group and trade partner in the base period

	Agricultural products	Food products	Industrial products	Services
Israel	0.0	0.0	21.0	0.0
USA	0.1	25.1	0.0	0.0
EU-28 + EFTA	0.6	6.3	0.0	0.0
Turkey	0.0	32.3	0.0	0.0
Jordan	0.0	26.0	0.2	0.0
GAFTA zone	0.1	17.8	0.2	0.0
Rest of the world	37.3	58.8	65.4	0.0

Source: West Bank SAM.

9.3.2. Model

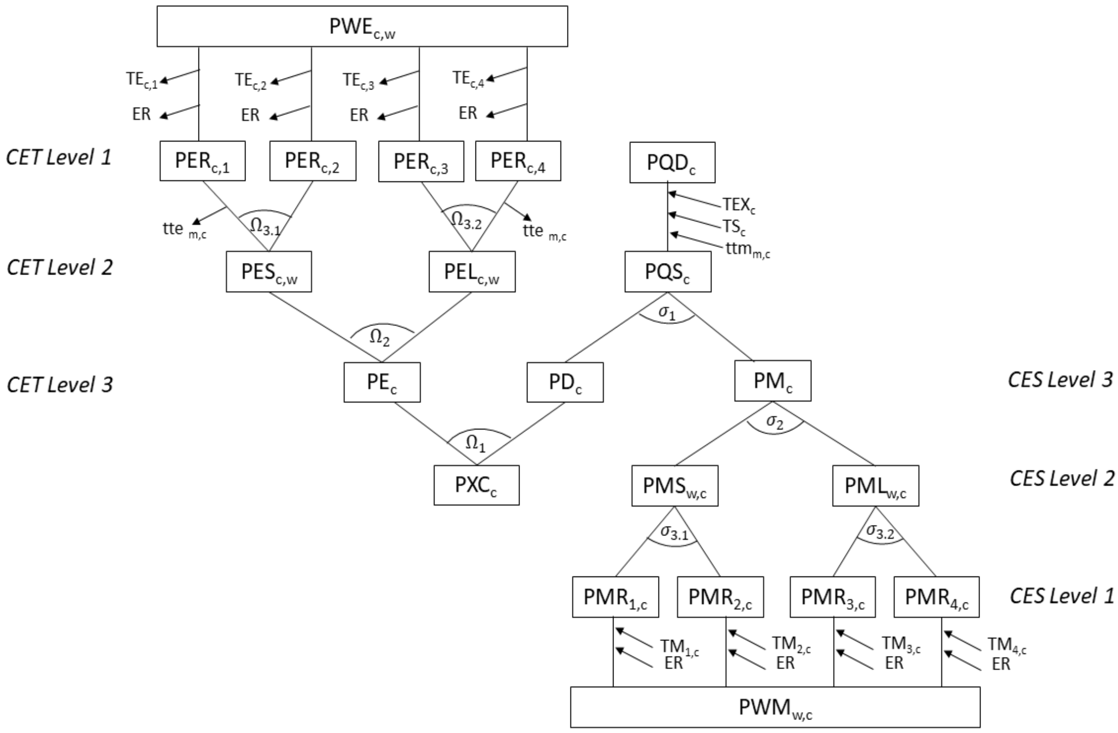
For this chapter, the following modifications are implemented in the STAGE-2 model. First, a multiple trade partner setup is introduced in order to capture Palestine's membership in different preferential trade agreements. Second, regions accounting for small shares of import/export of a commodity are treated differently from those representing large shares. This treatment aims at avoiding that the regions with small shares have disproportionately large terms of trade effects after the simulation of a policy shock. For this purpose, a modified version of the approach developed by McDonald and Thierfelder (2015) is used and is described as follows.

On the import side, if a trade partner *w* accounts for more than 10% of the Palestinian import for a commodity *c*, then for that commodity this trade partner falls in the sub-nest of large partners. If the import share of a trade partner is less than 10% of the total import of a commodity, that trade partner falls in the sub-nest of small partners for this specific commodity. In each sub-nest, the characteristics of the product are assumed to be closer, and hence a high substitution is allowed. From the sub-nests, two aggregates are generated. A lower substitution is assumed between the two aggregates, implying that import from a small trade share region can substitute import from a large trade share region but to a lower extent. On the export side, a similar nesting structure is developed using constant elasticity of transformation functions. The values of the elasticities used at each level of the price system are displayed in Appendix 4.

Figure 9-1 presents the price system in the model with an indicative number of four trade partners. The domestic consumer prices (PQD) are a composite of the supply prices (PQS), to which trade and transport margins (ttm) as well as the sales (TX) and excise taxes (TEX) are added. The supply prices are determined by the domestic prices of domestically supplied commodities (PD) and the domestic prices of composite imports (PM). PM is a volume-weighted average of the composite prices of regions with large (PML) and small import shares (PMS). PML and PMS in turn are CES aggregates of the domestic prices paid for imports from individual regions (PMR). PMR prices are expressed in the domestic currency after conversion of the international market prices (PWM) using the nominal exchange rate (ER[18]) and including the tariff (TM) associated with each trade partner.

With Palestine being a small player in the international markets, the small country assumption is implemented by fixing the international market prices. In other words, both Palestinian importers and exporters are price takers in the international markets. The domestic prices of exported commodities (PER) are obtained after converting the international market prices (PWE) into the domestic currency and deducing the export taxes (TE). The composite prices of exports to regions with large (PEL) and small trade shares (PES) are volume-weighted averages of the domestic prices of exports to individual trade partners, after deducing the trade and transport margins for exported commodities (tte). The prices of composite exports (PE) are CET aggregates of the composite prices for regions with large and small export shares. The producer prices (PXC) are determined by the prices of composite exports and the domestic prices of domestically supplied commodities (PD).

Figure 9-1. Commodity price system



Source. Own illustration.

[18] The Exchange rate is defined in domestic per world unit

To model tariff-rate-quotas (TRQ) on food and agricultural products, a modified form of the mixed complementary problem used by van der Mensbrugghe et al. (2003) and Flaig et al. (2013) is adopted. Accordingly, the quantity imported by region and commodity (QMR) consists of in-quota imports (QMI) and out-of-quota imports (QMO). Should the level of imports be below the quota (QMQ), then the quota is not binding. The domestic price of import (PM) equals the border price, i.e. the price in the international markets (PWM) converted in the local currency using the nominal exchange rate (ER), times 1 plus the in-quota tariff rate (τ^{i}) (Equation [9.1]). If the level of imports equals the quota, i.e. the quota is binding, PM equals the border price (PWM*ER) times 1 plus τ^{i} plus a premium (τ^{p}) (Equation [9.2]). If the level of imports surpasses the quota, the quota is no longer binding and the out-of-quota tariff rate (τ^{o}) applies to all out-of-quota imports. Therefore, PM equals the border price (PWM*ER) times 1 plus τ^{o}(Equation [9.3]).

$$\mathbf{PM_{w,c}} = (\mathbf{PWM_{w,c}} * \boldsymbol{ER}) * \left(\mathbf{1} + \boldsymbol{\tau}^{\mathbf{i}}_{\mathbf{w,c}}\right) \quad \text{with} \quad \mathbf{QMR_{w,c}} < \mathbf{QMQ_{w,c}} \quad [9.1]$$

$$\mathbf{PM_{w,c}} = (\mathbf{PWM_{w,c}} * \boldsymbol{ER}) * \left(\mathbf{1} + \boldsymbol{\tau}^{\mathbf{i}}_{\mathbf{w,c}} + \boldsymbol{\tau}^{\mathbf{p}}_{\mathbf{w,c}}\right) \quad \text{with} \quad \mathbf{QMR_{w,c}} = \mathbf{QMQ_{w,c}} \quad [9.2]$$

$$\mathbf{PM_{w,c}} = (\mathbf{PWM_{w,c}} * \boldsymbol{ER}) * \left(\mathbf{1} + \boldsymbol{\tau}^{\mathbf{o}}_{\mathbf{w,c}}\right) \quad \text{with} \quad \mathbf{QMR_{w,c}} > \mathbf{QMQ_{w,c}} \quad [9.3]$$

In Equation [1], the premium τ^{p} is zero, while in Equation [9.2] it lies between zero and the difference between the in- and the out-of-quota tariff rates ($\boldsymbol{\tau}^{\mathbf{o}}_{\mathbf{w,c}} - \boldsymbol{\tau}^{\mathbf{i}}_{\mathbf{w,c}}$). In Equation [9.3] τ^{p} is exactly the difference between the in- and the out-of-quota tariff rates. Equation [9.4] summarises the values taken by τ^{p} depending on whether the quota is not binding, binding or no longer binding.

$$\mathbf{0} \leq \boldsymbol{\tau}^{\mathbf{p}}_{\mathbf{w,c}} \leq \boldsymbol{\tau}^{\mathbf{o}}_{\mathbf{w,c}} - \boldsymbol{\tau}^{\mathbf{i}}_{\mathbf{w,c}} \text{ with } \quad \mathbf{QMO_{w,c}} \geq \mathbf{0} \quad [9.4]$$

For agricultural and food products, the tariff rate (TM) is composed of the in-quota tariff (τ^{i}) that is levied on the total import (QMR) and the quota premium (τ^{p}) that applies only to the out-of-quota imports (QMO) (see Equation [9.5]).

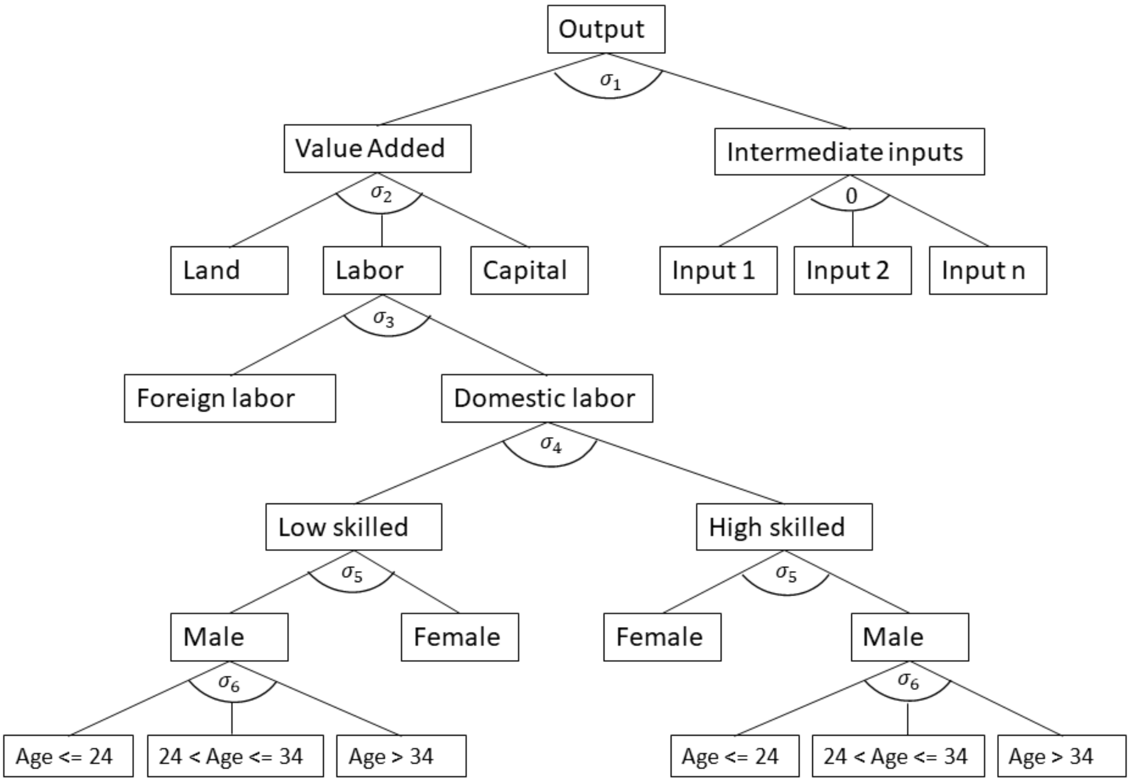
$$\boldsymbol{TM_{w,c}} = \frac{(\boldsymbol{\tau^{i}_{w,c}} * \boldsymbol{QMR_{w,c}}) + (\boldsymbol{\tau^{p}_{w,c}} * \boldsymbol{QMO_{w,c}})}{\boldsymbol{QMR_{w,c}}} \quad [9.5]$$

As import licenses are distributed to Palestinian importers free of charge, the quota rent then accrues to the Palestinian enterprises as shown in Equation [9.6] where YENT is the enterprise basic income and YE is the final income including the quota rent.

$$\boldsymbol{YE} = \boldsymbol{YENT} + \sum_{w,c}\left(\boldsymbol{\tau^{p}_{w,c}} * \boldsymbol{PWM_{w,c}} * \boldsymbol{QMI_{w,c}} * \boldsymbol{ER}\right) \quad [9.6]$$

The production module of the STAGE-2 model is modified to accommodate a six-level production process that reflects the composition of the labour force in the West Bank. Each level of the production process involves CES or Leontief aggregation functions (Figure 9-2). The values of the elasticities used are reported in Appendix 5.

Figure 9-2. Production module



Source. Own illustration.

9.3.3. Model closures

The model is investment-driven as investments in the West Bank economy are largely exogenous. The level of investment is defined in terms of the final demand because economic growth in the West Bank is likely to be correlated with a lower tension with Israel providing a secured environment that will attract more foreign investments (Naqib, 2003). To keep the balance between savings and investments, the household and enterprise savings rates vary equiproportionately. Government savings are fixed and the direct tax rate adjusts multiplicatively to maintain the balance. The choice to let the direct tax rate adjust and not any other tax rate is based on the progressivity of the direct tax rate, which is absent in the other tax instruments. Government consumption is a fixed share of the final demand, such that when the final demand increases as the economy expands, the government consumption follows. This assumption is grounded in the tendency of the public sector in Palestine to expand quickly (UNCTAD, 2006). To close the foreign market, the current account balance is fixed to avoid any borrowing from foreign funds and thus a transfer of welfare effects to future periods. For international trade, it is assumed that, after exiting the customs union with Israel, Palestine also leaves the currency union and creates its own currency. A floating exchange rate is implemented as this currency regime provides the highest monetary autonomy (Yoshino *et al.*, 2004). Finally, the consumer price index serves as the numeraire in the model.

All factors are mobile across activities. Capital and land are fully employed, as there is no evidence of a spare capacity for these factors in the West Bank economy. By contrast, the official statistics report a substantial unemployment rate of labour caused by the volatility of Palestinian employment in Israel and the low capacity of the domestic market. Moreover, the higher wages paid to Palestinian workers in Israel drive wages in the domestic market above their equilibrium level. To replicate this empirical evidence within the model, the surplus labour assumption is used. This assumption corresponds to a horizontal labour supply curve, implying that additional labour can be drawn into employment at zero marginal cost. Hence, the assumption is that the unemployed labour would take employment at the current real wage rates if there were employment opportunities.

In this model, a regime switching specification of the surplus labour assumption is adopted. As long as there is unemployed labour, the supply curve is perfectly elastic, i.e. horizontal, and real wages are fixed. Once the pool of unemployed labour is emptied, the supply curve becomes perfectly inelastic, i.e. vertical, and any further labour demand is translated into increasing wages. This specification avoids an infinite supply of labour by restricting the size of the unemployed labour. The number of unemployed persons in the West Bank is determined based on official statistics for 2011 (PCBS, 2012a).

Regarding international trade and foreign market closures, two alternatives to a floating exchange rate combined with a fixed current account balance are explored and the results are reported as sensitivity analysis:

1. In the first alternative, called Alternative 1, a Palestinian currency is considered, but instead of a floating exchange rate regime, a currency-peg against a basket of foreign currencies[19] is implemented. This alternative closure is implemented by fixing the real exchange rate. The producer price index serves as the numeraire in the model. The current account balance is kept flexible implyinf that Palestine has extensive access to foreign capital markets.

2. In the second alternative closure, called Alternative 2, Palestine is assumed to still peg its currency against a basket of foreign currencies but cannot borrow indefinitely from

[19] A basket-peg is widely seen as more desirable than a bilateral-peg for a small economy (see Schenk and Singleton, 2011; Yoshino *et al.*, 2004 and Argy *et al.*, 1989)

the foreign capital markets. Subsequently, both the exchange rate and current account balance are fixed. The exchange rate serves as the numeraire in the model.

9.4. Simulations

The analysis compares the outcomes of the current policy framework (the *status quo* represented by a base scenario that reflects the base data in the SAM) to two different trade policy scenarios, both assuming the exit from the customs union with Israel. The two scenarios can be regarded as extreme and were chosen on purpose to reflect the range of effects a change in trade policy could have on the West Bank economy.

Scenario 1 simulates the elimination of tariffs on imports from all trade partners. It represents a non-discriminatory liberalisation of the West Bank external trade and is called *ND-Lib* scenario. To keep the scenario realistic, only the in-quota tariff rates are removed for agricultural and food products. The size of the quotas and the out-of-quota tariffs rates are left unchanged to reflect a certain protection of the domestic agricultural and food sectors. Later in the sensitivity analysis, a change in the size of the quotas is simulated to assess the effects of protecting the domestic agricultural and food sectors on the whole economy.

Scenario 2 introduces high tariffs on imports from Israel. It considers the West Bank to exit the customs union without forming any other preferential trade agreement with Israel. Israel is treated similar to other trade partners without specific trade agreement and falls under the MFN trade regime. Scenario 2 is referred to as *MFN* scenario. The tariff structure with respect to the other trade partners is unchanged[20]. Table 9.3 presents the weighted tariff rates, where the weights are the volumes of imports for the respective commodities in the base situation, as well as the rates in the different scenarios.

[20] Exiting the current customs envelope with Israel is likely to be associated with more restricted access for Palestinians to the Israeli labour market, which is not captured in this chapter for simplicity reasons. Similarly, the *ceteris paribus* assumption applies regarding potential changes in Israeli trade policy towards Palestine. A sovereign Palestinian state with full control over its territory is likely to be associated with reduced transaction costs related to removing the existing internal closures. Likewise, building and maintaining a customs administration at the borders involves costs. These different aspects are ignored in this study for simplicity reasons. Changes in the access of Palestinian labour to Israeli markets are simulated in Chapter 6, Chapter 7 and Chapter 8 of this thesis.

Table 9.3. Weighted tariff rates (in %) aggregated over all commodities in the base and the two scenarios

	Base	*ND-Lib scenario*	*MFN scenario*
Israel	15.3	0.0	55.5[21]
USA	3.2	0.0	3.2
EU-28 + EFTA	0.8	0.0	0.8
Turkey	5.9	0.0	5.9
Jordan	4.3	0.0	4.3
GAFTA zone	7.6	0.0	7.6
Rest of the world	62.7	0.0	62.7

Source: Own calculations.

9.5. Results and analyses

This section starts with a presentation of the effects of the two policy scenarios assuming a floating exchange rate, and an employment in the domestic market that increases without changes in the wage rates until the pool unemployed labour is exhausted. Next, the sensitivity of the results to changes in the exchange rate regime is analysed. Due to space contingency, the results are mostly displayed for aggregated categories.

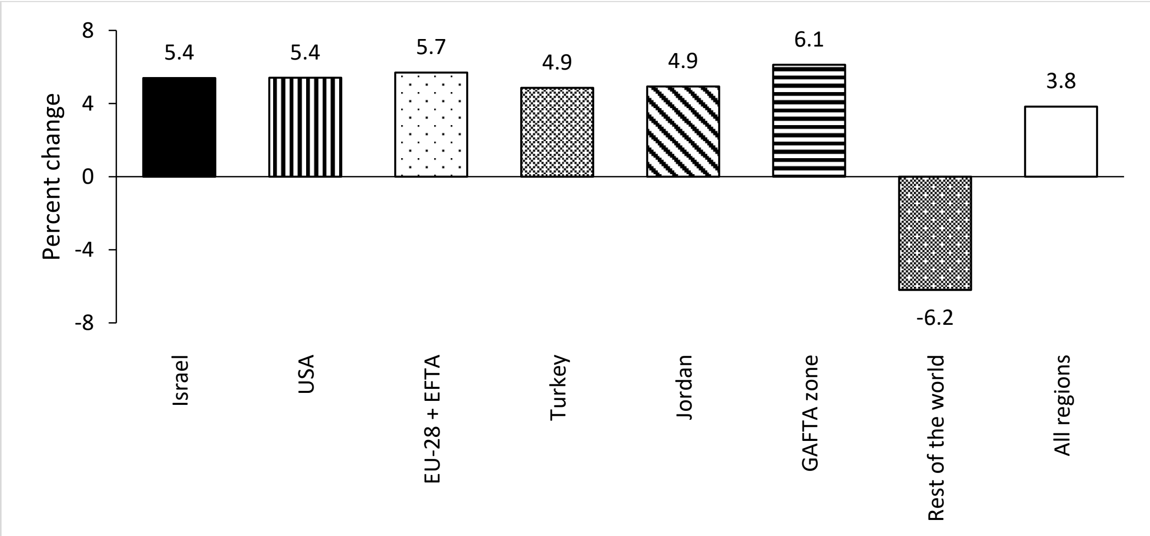
9.5.1. Effects on trade performance

In the *ND-Lib* scenario, the elimination of tariffs on imports from all trade partners makes the domestic prices of imports ecrease which in turn raises demand for imported commodities. Due to the rising import demand, the exchange rate adjusts with a currency depreciation of 7.0%. Because of the currency depreciation, the domestic prices of imports increase. The net effect of the currency depreciation and tariff elimination varies according to the region and depends on the height of initial tariff rates. For the "rest of the world" region, which initially carries the highest tariff rates, the effect of eliminating the tariffs predominates and leads to a net decline in the domestic prices of imports by 6.2%. For the other regions, which have preferential trade agreements with Palestine and with originally low tariff rates, the currency depreciation effect dominates with the outcome of increasing

[21] For the MFN scenario, the tariff rate on individual commodities imported from the rest of the world region in the base period is applied to imports from Israel. Using the weighted averages to come to one figure that can be displayed in the table leads to a weighted tariff rate for Israel in the MFN scenario of 55.5% that is different from the 62.7% for the rest of the world in the base period because the volumes used as weights are different for the two regions. Tariff rates applied – per product – to imports from Israel in the MFN scenario correspond to the column of Appendix 9 that refers to in-quota tariff rates for the rest of the world.

the domestic prices of imports between 4.9% and 6.1% (Figure 9-3). The domestic price of composite imports, which is the volume-weighted average of the prices of imports from individual regions, increases by 3.8%. In other words, the price drop for imports from the "rest of the world" region is overcompensated by the price increase for imports from the other regions. This result reflects the initially low share of the "rest of the world" region in the West Bank total imports (see Table 9.1).

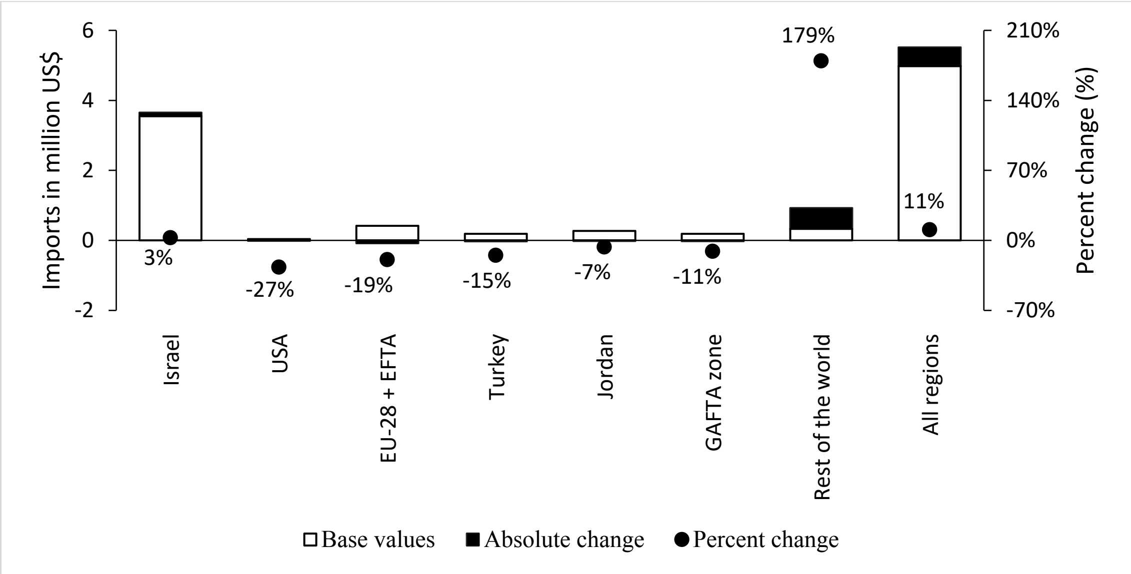
Figure 9-3. Change in domestic prices of imports by region in the ND-Lib scenario



The net effect of removing tariffs is an increase in the West Bank total imports by 10.7%. However, the change in the imported quantities differs across trade partners. Because of the price drop, imports from the "rest of the world" region more than double (Figure 9-4). The import share for the "rest of the world" region jumps from 6.6% to 16.7%. Imports from Israel experience a 2.7% increase due to two effects. First, for some commodities, Israel is the dominant if not the only source of the West Bank imports. Therefore, the general increase in demand in the economy leads to increasing import demand for those commodities that are imported only from Israel. Second, tariffs on imports from Israel initially applied only to petroleum products. Removing those tariffs decreases domestic prices and boosts the import demand for petroleum products from Israel. However, as total imports in the West Bank increases relatively more than imports from Israel, the import share of Israel declines from 71.3% to 66.2%.

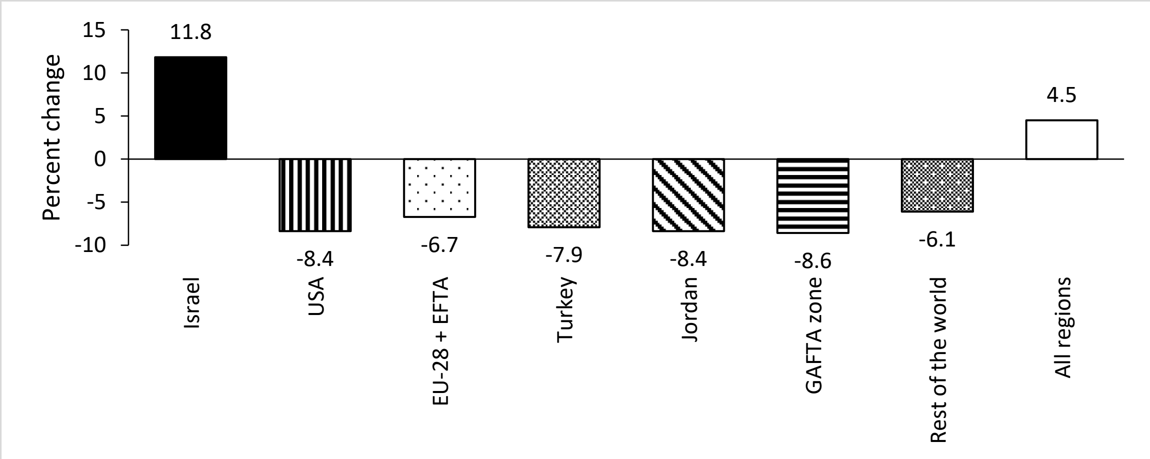
For the remaining five regions, both the import shares and the volume of imports decrease due the substitution effect with the "rest of the world" region. Most commodities imported from these five regions are also imported from the "rest of the world". Hence, the change in relative prices favours substituting commodities from these regions with imports from the "rest of the world" which experience a strong price decrease. These findings show that adopting a non-discriminatory trade policy will change the pattern of Palestinian trade by reducing trade diversion caused by the customs union and existing trade agreements. Nevertheless, Israel will remain West Bank's main trade partner. This finding confirms the prediction of Arnon and Weinblatt (2001) that Israel, due to the size of its economy and its proximity to the West Bank, will remain the West Bank's major trade partner.

Figure 9-4. Volume of imports by region of origin in the ND-Lib scenario as compared to the Base (in million US$ and % change)



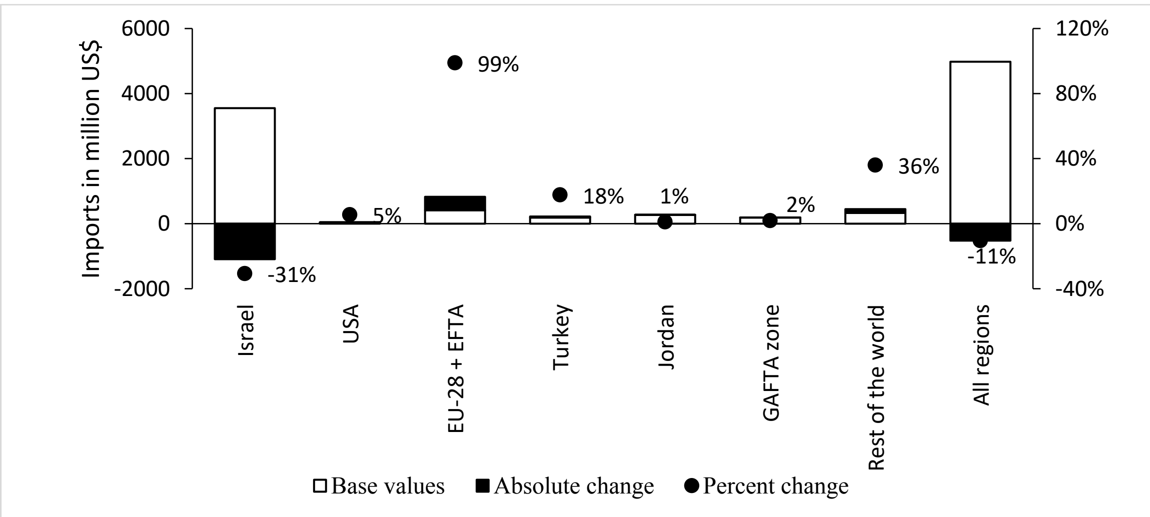
In the *MFN* scenario, the most-favoured-nation tariffs are applied to imports from Israel and they trigger an increase in the domestic price of imports from Israel by 11.8% (Figure 9-5). For the other regions, whose tariff rates remained unchanged, the decrease in the domestic price of imports stems from the appreciation of the local currency by 10%. The net increase in the price of composite import by 4.5% reflects the large initial share of Israel in the West Bank's total imports.

Figure 9-5. Change in domestic prices of imports by region in the MFN scenario



Because of the price increase, the volume of imports from Israel drops substantially by about one third and drives total import demand in the West Bank down by 10.5% (Figure 9-6). While the total import demand declines, the volume of imports from the other six regions increases, implying that imports from those regions to some degree substitute imports from Israel. This substitution effect is particularly important for the regions "EU-28 + EFTA" and "rest of the world", for which the import demand increases respectively by 98.8% and 35.9%. Whereas the import share for Israel diminishes strongly from 71.3% to 55.1%, the regions "EU-28 + EFTA" and "rest of the world" increase their import shares respectively from 8.3% to 18.5% and from 6.6% to 10.1%. These results show that introducing tariffs on imports from Israel can contribute to diversify the Palestinian import sources and to reduce the trade diversion effect of the customs union with Israel.

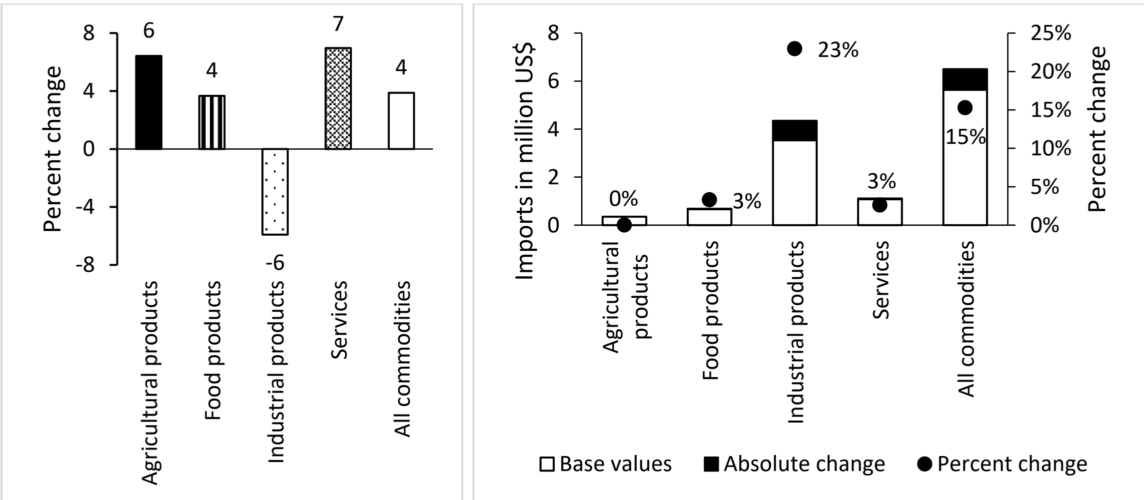
Figure 9-6. Volume of imports by region of origin in the MFN scenario as compared to the base (in million US$ and % change)



The change in domestic price of composite imports, which is the volume-weighted aggregate of the imports from individual regions, varies according to the commodity group (Figure 9-7a). In the *ND-Lib* scenario, it increases for all commodity groups, except for industrial products. The increase in the domestic price of composite imports for services by 6.9% only reflects the currency depreciation since services do not carry any tariff in the base period (see Table 9.2). For agricultural and food products, the increase in the price of composite imports is not only related to the currency depreciation but also to the tariff rate quota system. In fact, after removing the in-quota tariffs, the allowed quotas for several agricultural and food commodities are reached. As a result, the imported quantity of food and agricultural products remains fairly constant (Figure 9-7b). There are no out-of-quota imports. Instead, the domestic price of composite import increases, reflecting the protection of the domestic agricultural and food sectors. As for the industrial products, no quota was specified initially and the tariff rates applied were high. Subsequently, the effect of removing the tariffs outweighs the currency depreciation effect and leads to a price drop by 6.0% for imported composite industrial products. As their prices drop, the volume of imported industrial products increases by 23.0%.

Figure 9-7. Change in domestic prices and volumes of composite imports by commodity in the ND-Lib scenario

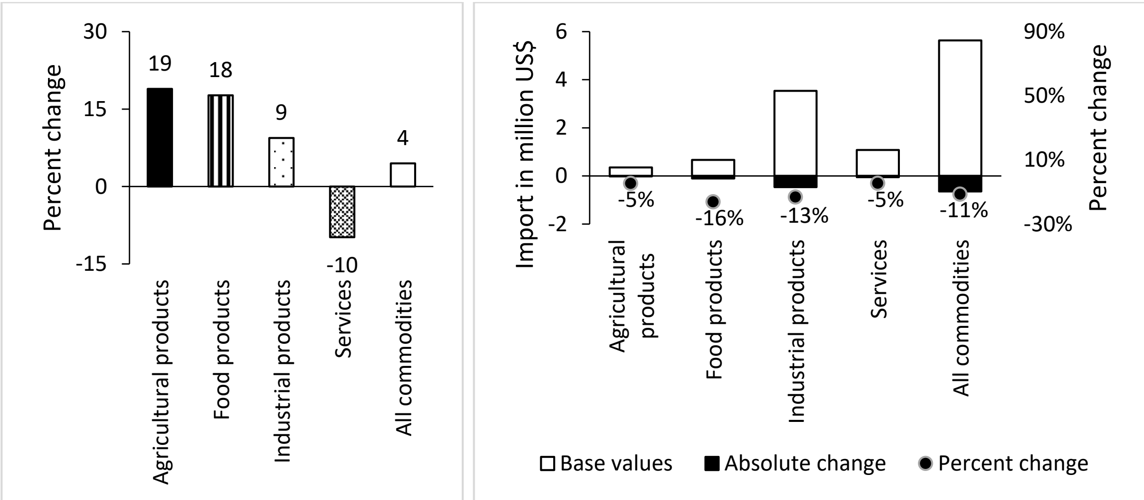
a. Domestic prices of composite imports b. Volume of imports by commodity group



In the *MFN* scenario, the domestic prices of composite imports increase for goods (agricultural, food and manufactured products), because in this scenario the additional tariffs on imports from Israel are only introduced on goods and not on services. Therefore, while the price of composite imports decreases for services by 9.8% due to the currency appreciation, for goods the effect of the additional tariffs outweighs the effect of the currency appreciation (Figure 9-8a). Import prices increase strongly for agricultural and food products (18.9% and 17.8% respectively), but moderately for industrial products (9.4%). This differentiated effect stems from the tariff-rate-quota mechanism, with the allowed import quotas for some regions being reached for a number of agricultural and food products. In quantity terms, the increase in prices for agricultural, food and industrial products is translated into a drop in the import demand for these commodities (Figure 9-8b). The import demand for services also declines by 4.7% because the overall demand in the economy falls, as will be discussed in more detail in Section 9.5.3.

Figure 9-8. Change in domestic prices and volumes of composite imports by commodity in the MFN scenario

a. Domestic prices of composite imports   b. Volume of imports by commodity group



On the export side, the price of composite export increases on average by 5.3% in the *ND-Lib* scenario, and it decreases on average by 8.5% in the *MFN* scenario. The price change in both scenarios mainly reflects the change in the exchange rates, with a currency depreciation in the *ND-Lib* scenario, and a currency appreciation in the *MFN* scenario. The volume of export increases by 36.7% in the *ND-Lib* scenario, with the highest increase for industrial products. The finding that industrial products benefit more from the increased export capacity stems from these products being in the base period the leading exports in the West Bank. By contrast, in the *MFN* scenario, the export supply decreases by 33.5% and the industrial products experience the highest decline. These findings stem from both the changes in the price of composite export and changes in the domestic output (more detail in Section 9.5.2). In the *ND-Lib* scenario, both real import and export values increase and the net trade effect is that the Palestinian trade deficit increases by 9.2%. In the *MFN* scenario, both real import and export values decline and the net effect is a reduction in the trade deficit by 5.2%.

9.5.2. Effects on domestic output and unemployment

In the *ND-Lib* scenario, the depreciation of the local currency stimulates domestic production, and domestic sectors increase their demand for production factors. For labour, this results in people moving out of unemployment. Hence, unemployment decreases substantially from 17.3% to 5.9% (Table 9.4). Among labour categories, full employment is reached for low-skilled females and high-skilled males. Unemployment persists only for the labour groups with high unemployment rates in the base period. By contrast, in the *MFN* scenario, domestic production shrinks and thus unemployment rates increase. Thereby, unemployment rates increase relatively more among low-skilled females and high-skilled males, which in the base period face the lowest unemployment rates (Table 9.4). These findings confirm the leverage effect that trade policy has on unemployment rates and hence endorses the results of UNCTAD (2009) suggesting that the Palestinian authorities can achieve considerable reduction in unemployment should they be empowered with full control over trade policy instruments.

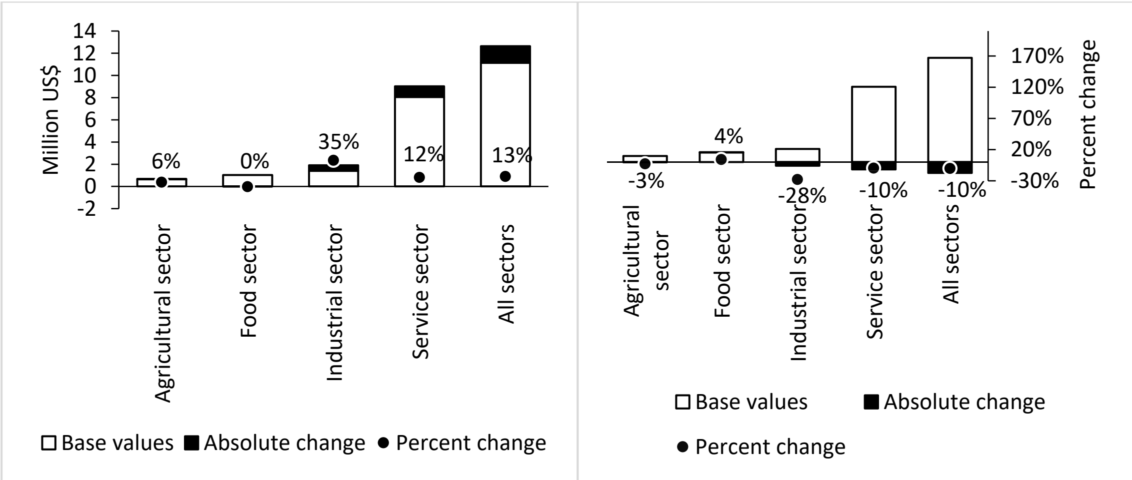
Table 9.4. Unemployment rates (in %)

	Base scenario	*ND-Lib* scenario	*MFN scenario*
Low-skilled male	17.4	5.2	27.3
Low-skilled female	8.8	0.0	17.3
High-skilled male	11.2	0.0	22.4
High-skilled female	32.6	22.4	40.4
Total labour	17.3	5.9	27.0

In the *ND-Lib* scenario, wages increase for the labour categories for which full employment is reached. On average wages increase by 0.9%. For capital and land that are assumed fully employed, factor price increases substantially more (by 21.5% and 9.1%, respectively). The increase in factor prices ultimately leads to increasing production cost by 2.3% on average across domestic sectors. Despite the increased production cost, increasing domestic demand leads to domestic output increasing on average by 13.3%. Domestic output rises more in the industrial and service sectors as compared to the agricultural and food sectors (Figure 9-9a). This effect comes mainly from the demand side. With increasing household income, the demand for industrial products and services rises strongly because the income elasticity of demand (see Appendix 6) for these two commodity categories is high. The income elasticity of demand for agricultural and food products is lower because they are "necessity" commodities. Accordingly, the increase in demand for these commodities in the *ND-Lib* scenario is low. In the *MFN* scenario, in which the overall economy shrinks, demand for the "necessity" commodities remains relatively stable, while it decreases for services and industrial products. The consumption signals are transmitted to the production system causing output to fall in the service and industrial sectors (Figure 9-9b).

Figure 9-9. Domestic output by sector

a. ND-Lib scenario *b. MFN scenario*

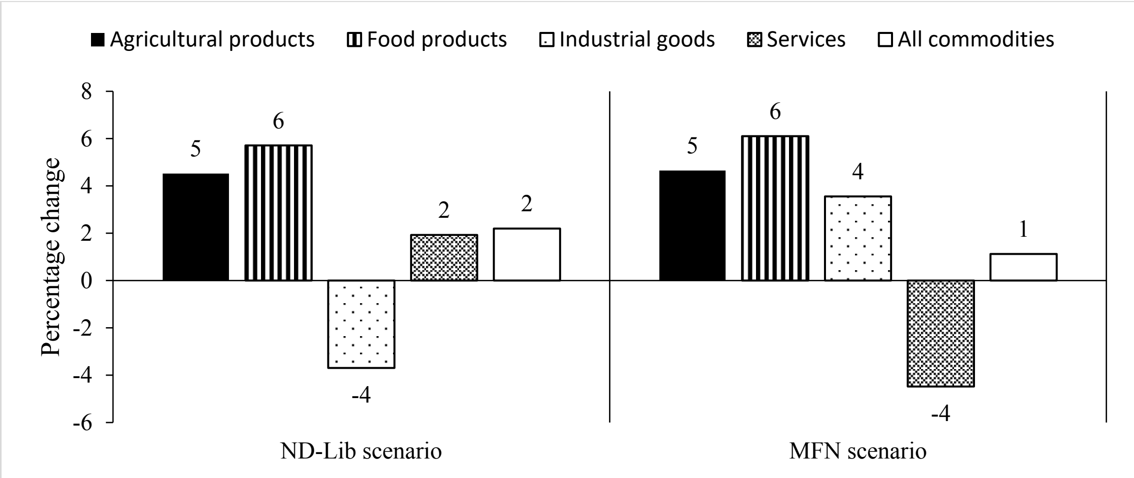


9.5.3. Effects on final consumption

The changes in domestic consumer prices are predominantly determined by changes in the price of composite imports, production costs, as well as changes in the domestic demand and transport and trade margins. In the *ND-Lib* scenario, the margins increase by 2.1%, the production costs increase across all sectors by 2.3% on average, and the price of composite imports increases for all commodity groups, except the industrial products (see Figure 9-7a). The finding that the domestic consumer prices increase across all commodity groups, except for the industrial products (Figure 9-10), shows that the effect of the decreasing price of composite imports for industrial products outweighs the increase in their production costs and in the margins. To understand this finding, one needs to look at the initial shares of imports and domestic production in total supply, since the domestic consumer prices are volume-weighted averages of the prices of composite imports and domestically supplied commodities. For industrial products, imports initially account for 82.7% of total supply (see Appendix 7). This large share of imports in total supply explains the dominating effect of the change in the prices of composite imports in determining domestic consumer prices.

In the *MFN* scenario, the production costs decrease on average by 2.7% in all sectors, and the margins decrease by 8.2%. For services, the price of composite imports also decreases (see Figure 9-8a). Subsequently, the domestic consumer prices decrease for services. For agricultural, food and industrial products, while the production costs and the margins decrease, the prices of composite imports increase (see Figure 9-8a). The finding that the domestic consumer prices for these three categories increase (Figure 9-10) can also be traced back to the initial shares of imports in total supply (see Appendix 7). These shares are on average high for goods (68.6%) and low for services (12.2%).

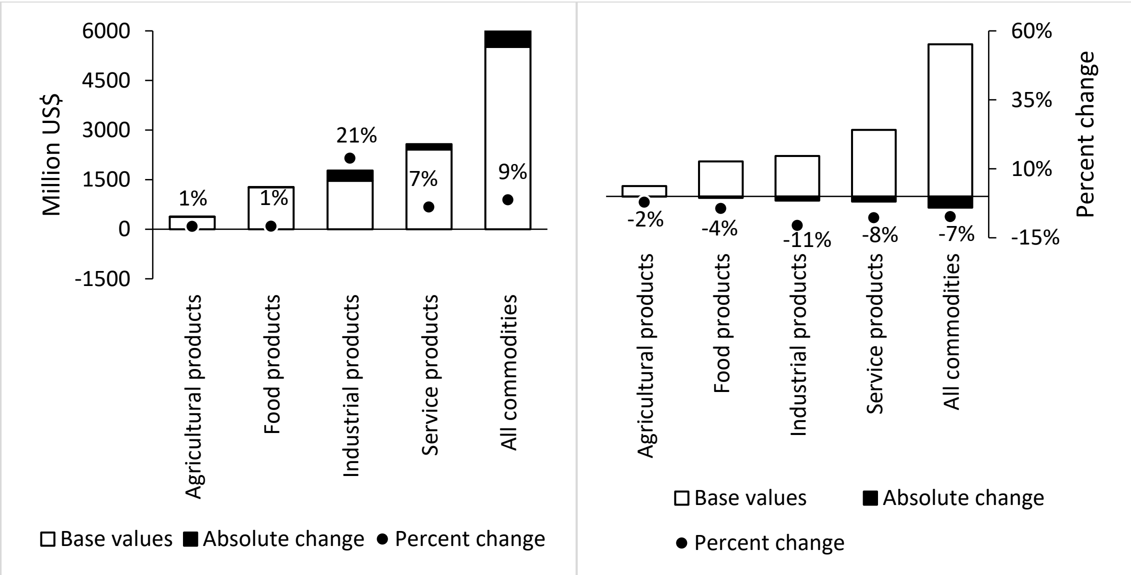
Figure 9-10. Change in consumer prices by commodity group



Changes in the final consumption are mostly determined by household consumption. In the *ND-Lib* scenario, household consumption increases for almost all commodities (Figure 9-11a), because households enjoy a higher income through the production factors they own. Consumption increases the most for industrial products and services due to the higher income elasticity of demand for these products. By contrast, in the *MFN* scenario, household income decreases driving overall consumption down, with consumption of industrial products and services being the most negatively affected (Figure 9-11b).

Figure 9-11. Household consumption by commodity group

a. *ND-Lib* scenario b. *MFN* scenario



9.5.4. Effects on household income and expenditure

Households in the West Bank derive most of their income from labour earnings and capital returns (see Appendix 11). In the *ND-Lib* scenario, total labour income increases by 14.5%, driven by both the increased employment and higher wages. Total capital return increases by 21.0% due to a higher capital rent. Subsequently, income increases for all household quintiles by 15.3% on average. As capital return increases relatively more than labour income, the richer households – which derive more income from capital – experience a slightly higher income increase. Due to the raise in income, households also spend more. However, consumption expenditures increase on average only by 7.5%. The remainder of household income is spent on higher income taxes, but also set aside as savings or spent on transfers.

In the *MFN* scenario, the reduced employment drives income from labour down by 13.2%. As demand for capital decreases, the capital rent also decreases and ultimately total capital return declines by 19.1%. Consequently, income decreases for all household quintiles by 13.3% on average. It decreases slightly more for the richer households, since they derive a higher share of their income from capital which experiences the higher income drop. Similar to income, household expenditure declines by 8.4% on average. Household expenditure declines less than household income, because households reduce savings and transfers.

9.5.5. Changes in the Government revenue

The changes of tariff rates affect the tax revenue and hence total government revenue. Tariff revenue initially accounted for 29.3% of the government revenue. In the *ND-Lib* scenario, the government revenue increases by 6.4%, meaning that the loss in tariff revenue is overcompensated by the additional revenue from other tax instruments. Making government consumption a fixed share of the final demand in the model drives government expenditure up as final demand increases in the *ND-Lib* scenario. To finance the additional expenditure, government revenue has to increase. This model mechanism actually reflects a long-term adjustment, whereby the removal of tariffs stimulates consumption which increases the tax base for value added and sales taxes. The additional consumption also stimulates domestic production (see Figure 9-9) and household income (see Section 9.5.4), hence increasing the tax base for factor use and income taxes.

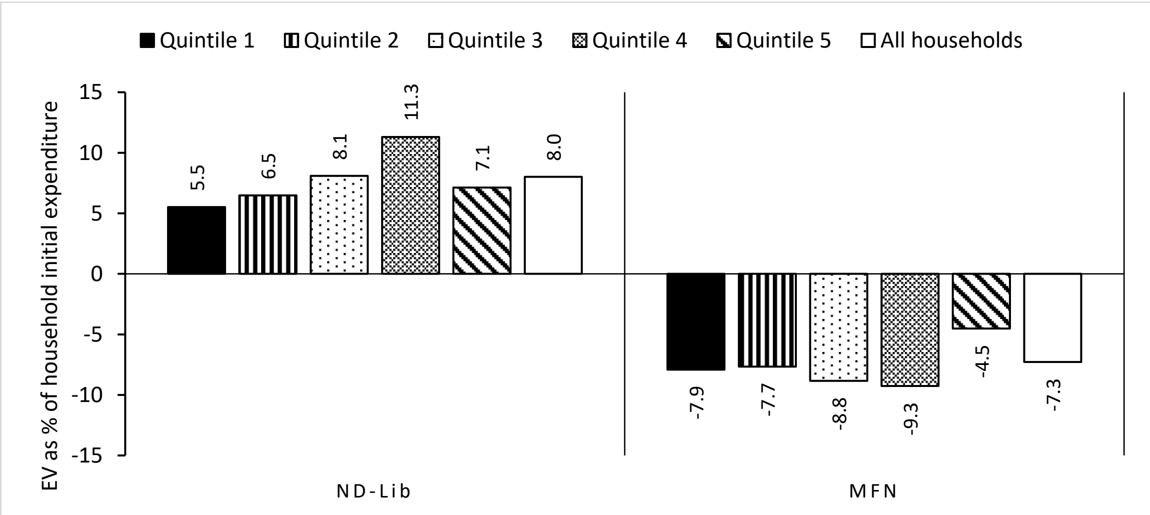
As all tax rates are kept fixed except the income tax rate, a substantial increase in the government income happens through the income tax instrument, which increases tenfold. This change is equivalent to an increase in the income tax rate from 0.9% in the base year to 8.9%. This rate change is substantial and it needs to be highlighted that the effective income tax rate in Palestine is much lower than the official rates, which are 5% for the lowest income bracket, 10% for the middle income bracket and 15% for the top income bracket (PIPA, 2017). Fjeldstad and al-Zagha (2004) show that the collection of income tax in Palestine is subject to negotiations in virtually all cases, and that the tax base is eroded by generous exemptions. Moreover, the tax administration suffers from insufficient resource allocation, and lack of human capital. Therefore, raising income tax rates effectively would require substantial institutional reforms.

In the *MFN* scenario, the introduction of tariffs on imports from Israel, which retains a share of 55.1% of the West Bank imports, together with increasing imports from the other trade partners (see Figure 9-6) generate a 66.8% increase in the tariff revenue. Nevertheless, as final demand decreases in the economy, tax revenue collected from the other instruments declines and ultimately government revenue decreases by 7.2%. Through the model mechanism, income tax revenue decreases the most and becomes negative, implying that the central government makes additional transfers to households and enterprises.

9.5.6. Welfare change and macroeconomic effects

A welfare indicator used to summarise the effects from changing prices and income on households is the equivalent variation[22] as a share of household initial expenditure. Figure 9-12 shows that welfare improves for all household groups in the *ND-Lib* scenario. The richer the household, the higher the welfare gain. The finding that welfare gains for households in quintile 5 is lower than that for households in quintile 4 is due to a welfare transfer from quintile 5 households to the others. In fact, 62.1% of all inter-households transfers in the West Bank, including the religious transfers from wealthy to poor households (*Zakat*), are conducted by quintile 5 households. Hence, the largest burden of the increased transfers falls on quintile 5 households reducing their welfare gain to the benefit of the other household groups. In the *MFN* scenario, welfare declines for all household groups. The richer the household the more the welfare loss. The welfare loss for households in quintile 5 is less than that of households in quintile 4 due to reduced inter-household transfers, dampening the welfare loss of households in quintile 5.

Figure 9-12. Change in household welfare by household quintile



Summarizing all the individual effects discussed above in the real GDP macroeconomic indicator shows that in the *ND-Lib* scenario, eliminating tariffs stimulates the West Bank economy, which grows by 8.37%. By contrast, a more restrictive trade policy – imposing new tariffs on trade with Israel (*MFN* scenario) – leads the economy to shrink by 8.42%. These results are in line with the predictions by Fischer *et al.* (2001) and Astrup and Dessus (2005) that a liberal and non-discriminatory policy is the most suitable trade regime for a sovereign Palestinian state.

[22] The Equivalent Variation is defined as the amount of compensation, that must be added (subtracted) to (from) household initial income, to leave that household as well off as under the combined price and income changes

9.5.7. Results with alternative exchange rate regimes

Two alternatives to the initial closure rules of a floating exchange rate regime combined with a fixed current account balance are simulated as described in Section 9.3.3. The two alternatives assume a fixed exchange rate or currency-peg. Alternative 1 assumes in addition a flexible current account balance, while Alternative 2 incorporates a fixed current account balance.

The results show that adopting a currency-peg, as assumed in both alternatives cause the domestic prices of imports to fall for all trade partners in the *ND-Lib* scenario, due to the removal of tariffs. In both alternatives, the domestic prices of imports drop relatively more for the region "rest of the world" because that region carries in the base period the highest tariffs. As compared to the initial model, where a floating exchange rate is assumed, the currency depreciation effect driving the domestic prices of imports from individual trade partners up does not play any role in the two alternative models. Similarly, in the *MFN* scenario, the currency appreciation depressing the domestic prices of imports in the initial model is absent. Only the additional tariffs introduced drive the domestic prices of imports from Israel substantially up and the domestic prices of imports from the other regions up as well.

While the price effects are similar in the two alternative models, the effects on the imported quantities differ considerably. In Alternative 1, the total import demand increases sharply in the *ND-Lib* scenario. The additional imports are financed by foreign borrowing, with the current account deficit increasing by 61.8%. However, in Alternative 2, the increase in import demand is much smaller because a fixed current account balance is assumed removing the possibility to borrow foreign money to finance imports. The additional import demand in Alternative 2 only originates from the "rest of the world" region, where the price drop is the strongest. In the *MFN* scenario, results of the Alternative 1 show a sharp decline in the import demand, which is associated with a reduction in the current account deficit by 54.8%. By contrast, the results of Alternative 2 indicate a more moderate decline in the total import demand. Table 9.5 summarises and compares the results of the original model with its two alternatives on domestic prices of import and total import demand in the West Bank.

Table 9.5. Impacts on import demand under three monetary policies

	Domestic prices of imports (% change)			Change in import demand (Million US$)		
	Initial model closure	Alternative 1	Alternative 2	Initial model closure	Alternative 1	Alternative 2
ND-Lib scenario						
Israel	5.4	-1.4	-1.4	97	338	-60
USA	5.4	-1.1	-1.5	-11	-9	-12
EU-28+EFTA	5.7	-0.9	-1.2	-79	-61	-95
Turkey	4.9	-1.4	-2.0	-28	-18	-34
Jordan	4.9	-1.5	-2.0	-18	14	-27
GAFTA zone	61	-0.7	-0.8	-21	0	-27
Rest of the world	-6.2	-11.7	-12.5	592	646	549
All regions	3.8	-2.8	-2.9	533	911	296
MFN scenario						
Israel	11.8	24.0	24.0	-1094	-1321	-981
USA	-8.4	1.4	1.8	2	-1	4
EU-28+EFTA	-6.7	3.1	3.5	410	347	454
Turkey	-7.9	1.8	2.3	33	14	42
Jordan	-8.4	1.3	1.8	3	-37	12
GAFTA zone	-8.6	1.2	1.6	3	-22	9
Rest of the world	-6.1	3.8	4.3	119	79	139
All regions	4.5	15.7	15.9	-524	-940	-320

At the macroeconomic level, the results of Alternative 1 are larger in magnitude than the results of the original model. In the *ND-Lib* scenario, fuelled by the additional borrowing from foreign markets, total demand in the economy increases, which stimulates the domestic production and ultimately the real GDP increases by 9.28%, as compared to 8.37% in the initial model. In the *MFN* scenario, about half of the foreign debt is repaid, instead of being reinvested in the economy. Subsequently, the final demand falls more rapidly than in the initial model. Ultimately, the real GDP drops by 10.03% as compared to 8.42% in the initial model. While in the *ND-Lib* scenario the model does not account for the repayment of the additional foreign debt at some point in the future, in the *MFN* scenario the repayment of the past foreign debt acts as a burden on the economy.

The results of Alternative 2 show more moderate effects of both trade scenarios on the economy. In the *ND-Lib* scenario, real GDP grows only by 2.02%, while in the *MFN* scenario it declines by only 0.90%.

In conclusion, these results indicate that the monetary policy adopted has a considerable impact on the outcomes of any trade policy. Therefore, the Palestinian authorities may want to have the fullest control over exchange rate and monetary policies.

9.6. Conclusions and policy implications

The Paris Protocol, which governs the economic relations between Israel and Palestine, formalised the customs union between the two parties. This customs union is largely based on Israeli rules. Due to the structural differences between the two economies, those rules are not favourable to the Palestinian economy. The Paris Protocol as a transitional agreement was supposed to pave the way for a final settlement, where a sovereign Palestinian state would eventually have full control over its trade and monetary policies. In the context of such a final settlement, this chapter simulates two trade options in which the customs union with Israel is assumed to be removed and trade policy is solely determined by the Palestinian authorities. The first scenario is the elimination of tariffs on imports from all trade partners (*ND-Lib* scenario), and the second scenario simulates the imposition of high tariffs on imports from Israel (*MFN* scenario).

Of the two analysed trade policy options, only the abolishment of tariffs on import from all trade partners, as simulated in the *ND-Lib* scenario, improves all macroeconomic indicators of the West Bank economy as compared to the *status quo* of a continued customs union. By contrast, introducing new tariffs on imports from Israel, as simulated in the *MFN* scenario, hurts the West Bank economy. Consequently, a sovereign Palestinian state may prefer to adopt a liberal and non-discriminatory trade regime. Adopting such a trade policy can diversify Palestinian trade and reduce the trade diversion caused by the current customs union and other trade agreements. Nevertheless, Israel is likely to remain the main corridor for the Palestinian trade, due to the size of its economy and its geographical position.

In the long-term, removing the customs union and its associated trade distortions will provide Palestine with more trade options than can be captured by the model. In fact, the model construction – while depicting well the current trade pattern – imbeds some of the distortions caused by the customs union. These distortions are twofold. First, there are indirect imports shown as imports from Israel which fully originate from other countries. A good example of this is petroleum products which constitute 23.5% of West Bank imports from Israel. Assuming an exit from the customs union and the possibility for

Palestine in the long-term to source these products directly from their origins will significantly reduce the trade share of Israel. Second, the initial position of Israel as the dominant trade partner is partly a result of trade diversion due to the customs union, with some products being sourced mostly or only from Israel. Hence, when the import demand increases, as in the *ND-Lib* scenario, the model setup only allows the additional demand for these products to be sourced from Israel, due to the Armington trade specification. However, exiting the customs union and removing its distortions may provide Palestine in the long-term with more possibilities to source those products from third countries.

The results show that eliminating tariffs on agricultural and food products hardly affects the imported quantities, because the domestic agricultural and food sectors are protected with a system of tariff-rate-quotas. The findings that quotas become binding and that there are no out-of-quota imports demonstrate the importance of modelling explicitly these tariff-rate-quotas. While the tariff-rate-quota system effectively protects domestic agricultural and food sectors against import competition, this protection comes at a cost for the whole economy. While farmers are better off, consumers are worse-off, and the economy as a whole bears a net welfare loss. To assess the effect of the tariff-rate-quota system on the economy, the two analysed trade options are simulated along with an increase in the import quotas by 50%. The results indicate that the outcome of both trade policy options is improved if the quotas are increased. In fact, increasing the quotas reduces the constraint imposed upon the economy and in both trade policy options more imports take place. Ultimately, real GDP increases in the ND-Lib scenario by 8.7% as compared to 8.4% when the quotas are not increased.

In the *MFN* scenario, real GDP decreases by 8.1%, while it decreases by 8.4% when quotas are not increased. A complete removal of the tariff-rate-quota system is likely to further magnify the positive benefits of the simulated trade policies for the economy as a whole, although domestic producers of agricultural and food products are hurt. Therefore, a revision of the tariff-rate-quota system is a political decision the Palestinian authorities should make depending on whether the national interest is to protect domestic producers and ensure domestic supply of food or to enhance the overall economic benefits that are achieved through trade. Revising the level of the tariff-rate-quotas will also depend on the final agreement with Israel, since the current levels are negotiated with Israel because of the two entities forming a customs union. If Palestine gains full control over trade and economic policy instruments in the final status, the Palestinian authorities may decide freely on the levels of their tariff-rate-quotas.

The results also highlight that trade policy in Palestine has a substantial leverage on unemployment. In the *ND-Lib* scenario, unemployment decreases from 17.3% to 5.9%. Hence, empowering the Palestinian authorities with full control over trade policy instruments can improve their capacity to tackle the unemployment problem. Changes in the employment rates have direct effects on household income, and thereby on household welfare. In the *ND-Lib* scenario, household welfare improves for all household groups by 19.9% on average. However, welfare gains are higher for richer households than for poorer households. Therefore, if the Palestinian authorities aim at a fairer distribution of the welfare gains, they should increase transfers to poorer households. Government revenue is expected to increase despite the loss of tariff revenue because the tax base for other tax instruments (VAT, income tax, sales tax) increases and income tax rate increases.

It is pertinent to note that the surplus labour assumption used in the model is likely to overstate the changes in employment, absorption, and in welfare gains in the *ND-Lib* scenario as the shock implemented increases wages. By contrast, this assumption is expected to understate the outcomes in the MFN scenario, as the shock implemented there reduces wages. These biases are due to the implicit assumption that employment within the System of National Accounts (SNA) production boundary, i.e. the market activities, can be increased at no marginal costs and the opportunity cost of labour outside the SNA boundary, i.e. the "unemployed" labour, is zero.

Because the two simulated trade options are arguably extreme cases, a moderate variant of the *MFN scenario* is simulated assuming that after the exit from the customs union, Palestine signs a preferential trade agreement (*PTA*) with Israel. In this *PTA* scenario, the average tariff on trade partners having already trade agreements with Palestine is applied to imports from Israel. In addition, the introduction of rules of origin causing higher transaction costs is assumed through an increase in prices for imports originating from Israel by 3.0% and a reduction in prices for exports to Israel by 3.0%. The results – as expected – are moderate as compared to those of the *MFN* scenario. As illustration, GDP decreases by 3.5% in the *PTA* scenario, as compared to 8.4% in the *MFN* scenario. This finding first shows that both *PTA* and *MFN* scenarios are less desirable than the *status quo* of continued customs union with Israel, since in both cases GDP decreases relative to the *status quo*. Second, this finding shows that the higher the tariffs introduced on imports from Israel, the worse the outcome for the West Bank economy. Hence, concluding a trade agreement with Israel is more desirable than trading with Israel under the most-favoured-nation trade regime.

In another variant of the *MFN* scenario, it was assessed whether forming a new customs union with the Arab countries members of the GAFTA free trade area could compensate the economic costs of imposing high tariffs on imports from Israel. In this *GAFTA customs union* scenario, tariffs on imports from the GAFTA members (GAFTA zone and Jordan) are removed, while applying the most-favoured-nation tariff rates to Israel. However, the results of the *GAFTA customs union* scenario hardly differ from those of the *MFN* scenario.

This finding reflects the fact that the GAFTA members only make a tiny share of the Palestinian trade and entering a GAFTA customs union will not compensate for imposing high tariffs on imports from Israel, which is likely to remain Palestine's main trade partner. Consequently, a greater integration with other Arab countries is important, but it cannot be a substitute to the economic links with Israel.

Finally, the monetary policy adopted has a substantial impact on the magnitude of the trade policy effects. Therefore, the PNA may want to gain the fullest control over its national currency and its exchange rate. The highest overall welfare gains could be achieved with the most liberal and non-discriminatory trade policy, i.e. abolishing tariffs and quotas with respect to all trade partners. Yet, for a fairer distribution of welfare gains, Palestinian authorities may want to compensate the losers, especially domestic producers of agricultural and food products, and may consider transfers to poor households, for whom welfare gains are smaller.

10

CONCLUDING REMARKS

Chapter 10 Concluding remarks

The movement of goods, services and labour is disrupted when political conflicts arise. In the case of the Palestinian-Israeli conflict, the asymmetry of power between the two parties in conflict leaves the Palestinian economy in a vulnerable position. Policies implemented by Israel, such as the work permit scheme and the closure policy, altered the flow of labour, goods and services between the two regions. Moreover, the agreement on economic relations signed by the two parties in 1994 which is supposed to enable a trade-led growth of the Palestinian economy actually provides the Palestinian National Authority only with limited policy space. Exploring the economy-wide implications of changes in the movement of goods, services and labour in conflict-affected regions, taking the case of the West Bank economy, is the core objective of this thesis.

This thesis uses a CGE model, as this class of models is well-suited to investigate the economy-wide effects of changes in policies and other external shocks. The next Section, 10.1, presents the main findings related to the research objectives. Section 10.2 highlights the contributions of this thesis to method development, while Section 10.3 pinpoints its policy implications. Finally, Section 10.4 discusses the limitations of the analysis and makes suggestions for future research.

10.1. Key findings and answers to the research questions

This thesis aimed at five research objectives, which are as follows:

a) Develop a detailed database to use in simulation models for assessing the economy-wide effects of policies in the West Bank
b) Identify the model specifications that capture the labour market conditions in the West Bank and quantify their implications for the simulation results
c) Analyse the short-term effects of changes in the employment of Palestinians in Israel on the West Bank economy
d) Assess the long-term effects of an increased employment of Palestinians in Israel on the West Bank economy
e) Investigate the effects of changes in the trade regime on the West Bank economy

To achieve the first research objective, a detailed Social Accounting Matrix (SAM) was developed for the West Bank and is documented in Chapter 5. This is the first social accounting matrix for the West Bank, which is currently the only Palestinian territory with official trade relations with Israel and with workers employed in the Israeli economy. The development of this database was the pre-requisite for the applications intended to be conducted. The West Bank SAM is sufficiently disaggregated in order to allow its future users to consider alternative classifications depending of the research question. The SAM explicitly distinguishes seven trade partners, among which Israel, the regions having preferential trade agreements with Palestine (USA, EU28 + EFTA, Turkey, Jordan and GAFTA countries) and the rest of the world.

The SAM has several distinctive features. It takes proper account of the remuneration of labour for the self-employed and of household income from unincorporated capital, and it explicitly includes an account for non-profit institutions serving households as well as the religious transfer (*Zakat*) flowing voluntarily from the rich households to the poor. It has a detailed representation of commodities and activities producing them. Labour markets and household accounts are well differentiated to allow assessing the effects of policy changes in the movement of labour, goods and services on the West Bank economy as well as their distributive effects on household welfare. The SAM was developed for the year 2011, for data availability reasons and also because the year 2011 can be considered as a year of relative stability, which can serve as a benchmark for simulation models.

The second research objective aimed at identifying the model specifications that can capture the labour market conditions in the West Bank and quantify the implications of using different assumptions on the simulation results. Chapter 6 first identifies four stylized specifications of labour market conditions: the fixed labour supply (full employment), surplus labour, upward-sloping labour supply curve and labour-leisure trade-off. Among the four specifications, the upward-sloping curve is found not to be neutral to welfare generated outside the SNA production boundary, as labour enters the SNA boundary at a positive price but has a zero opportunity cost outside the boundary (Aragie *et al.*, 2017). The fixed supply and surplus labour assumptions achieve a superficial neutrality with respect to welfare generated outside the production boundary. The fixed supply specification assumes a strict separability between uses of labour within and outside the boundary and considers households to be indifferent to changes in the wage rates in their decisions in the labour markets (McDonald, 2018). The surplus labour specification is also open to challenges as it assumes that labour has a zero opportunity cost outside the production boundary and employment can be increased within the boundary without increasing real wages (Boeters and Savard, 2011). The labour-leisure trade-off specification, in contrast to the others, accounts explicitly for welfare changes within and outside the boundary and is consistent with standard economic theories. However, it implicitly assumes the absence of involuntary unemployment.

After calibrating the West Bank SAM to a modified version of the comparative static single-country CGE model STAGE-2, the implications of using these four different model specifications on the simulation results were assessed. The shock implemented was a revert of the Palestinian employment in Israel to its 1999 *pre-intifada* level. This represents a 36% increase in the number of Palestinian workers in Israel as compared to the base year of 2011. The findings show that the surplus labour specification is arguably a better framework to depict the market conditions in the West Bank in the short-term as it produces results that reflect the empirical evidence of a closer correlation between the employment of Palestinians in Israel and the unemployment in the West Bank. This model specification captures the distortions in the West Bank labour markets which are in part caused by the volatility in Palestinian employment in Israel due to the conflict. This volatility combined with the small size of the internal market generates involuntary unemployment which cannot be properly captured by the fixed supply and labour-leisure trade-off specifications. The upward-sloping curve can also capture involuntary unemployment. Compared to the surplus labour specification, it generates relatively moderate results. While it is acknowledged that the surplus labour specification is likely to overstate the policy effects on absorption, employment and welfare, this specification is preferred to the upward-sloping curve, because it is neutral to welfare generated outside the production boundary and it is more consistent with the standard economic theories.

For a long-term analysis, the labour-leisure trade-off is the preferred specification because it explicitly accounts for welfare changes within and outside the production boundary. Moreover, in the long-term it is assumed that the labour markets are flexible and that labour can always be employed in the activities either within or outside the boundary. As compared to the fixed supply specification, the labour-leisure trade-off allows for transfers of labour across the boundary and hence supply of labour to the market activities is not perfectly inelastic. After reaching these conclusions, a thorough assessment of the effects of changes in the Palestinian employment level in Israel was carried out from a short-term perspective (Chapter 7) and from a long-term perspective (Chapter 8) to achieve the research objectives three and four.

In Chapter 7, the short-term effects of changes in the employment of Palestinians in Israel are assessed using the surplus labour assumption together with a segmentation of the factor markets. Hence, the mobility of labour is limited and factors are restricted to their initial market segments. The results of the first scenario show that increasing the employment of Palestinians in Israel to its *pre-intifada* level improves, in the short-term, the welfare of West Bank households by 5.5% on average. The majority (98%) of Palestinians from the West Bank who start employment in Israel are previously unemployed in the market activities. The increased labour income from Israel stimulates household consumption and both import demand and domestic production. To meet the additional demand for domestically produced commodities, domestic activities use more labour which leads to more labour starting employment in the domestic market. The total effect is a reduction in the unemployment rate from 17.3% to 10.9%. Ultimately, the West Bank economy grows with real GDP increasing by 3.6%.

The opposite scenario, reducing Palestinian employment in Israel by 36%, leads to a surge in the unemployment rate as those who are laid off from employment in Israel do not find opportunities in the domestic market. Moreover, the contraction of the economic activity due to a reduced household consumption leads to a reduction in labour demand by the domestic activities.

Increasing the employment of Palestinians in Israel, while restricting the access to the Israeli markets to male workers having a valid work permit for Israel, slightly reduces the benefits for the West Bank economy and for household welfare.

Assuming that the increased employment of Palestinians in Israel may stimulate the labour market participation in the West Bank, which is extremely low especially for women, magnifies the benefits to the economy and to household welfare.

In Chapter 8, the long-term implications of increased Palestinian employment in Israel are investigated using the labour-leisure trade-off specification. Additionally, the household utility function is modified and instead of a single-stage LES function, a three-stage LES-CES-CES function is used. This model specification is assumed to better reflect household preferences, assuming that households decide their subsistence consumption levels over two broad groups of commodities. Within each group, they substitute among the components of the group by choosing the optimal combination of commodities based on their relative prices. To reflect the long-term presumption of the analysis, a mobility function is incorporated into the model so that labour is no longer restricted to the initial market segments. The mobility function is controlled by a response elasticity and can be triggered by changes in relative wages.

The results show that only 23.6% of the Palestinian workers who start working in Israel were previously unemployed in the domestic market. This result confirms the finding of Boeters and Savard (2011) and Gronau and Hamermesh (2006) that household supply of labour to the market activities is fairly stable in the long-term. In the case of Palestinian employment in Israel, the additional inflow of labour income from Israel reduces incentives to work inside the SNA production boundary by increasing the price of non-traded commodities, of which the most "non-traded" is leisure, i.e. the services produced by activities outside the production boundary.

The results also show an increase in the domestic wages across all sectors by 6.1% on average. The increase in factor prices drives up the production cost, which coupled with the exit of labour out of the domestic market to take employment in the Israeli market, generate a decline in the domestic output by 2.1% on average. Output declines the most in the manufacturing sector which is the leading export sector in the West Bank. As the increased labour income from Israel causes a real appreciation of the domestic currency, the competitiveness of the West Bank export industry in the international markets is reduced. This finding highlights the trade-off between exporting more labour to Israel and exporting more goods and services to the rest of the world.

Due to the additional labour income from Israel, household consumption of goods and services increases on average by 3.7%, while consumption of services produced outside the boundary (leisure) decreases by 1.2%. Subsequently, there are welfare benefits generated within the production boundary, while there are welfare losses outside the boundary. The net effect is nevertheless a welfare gain for all household groups by 1.8% on average. At the aggregate economy level, real GDP declines by 1.1%. Hence, in the long-term, the employment of Palestinians in Israel poses a trade-off between household welfare gains and a shrinking production capacity for the West Bank economy.

Contrasting the long and short-term effects, this thesis shows that increased employment of Palestinians in Israel improves household welfare in both cases. While it stimulates the domestic economy in the short-term by absorbing a large fraction of the unemployed labour and by boosting household consumption, in the long-term it increases the domestic wages and removes incentives for domestic employers to invest and hire. Moreover, the inflow of labour income from Israel has "Dutch disease" effects through a real appreciation of the domestic currency, reducing the competitiveness of the West Bank export industry in the international markets. This in turn reduces incentives for domestic firms and contributes to shrinking the domestic economy. This finding has important policy implications as policymakers would aim at keeping the welfare gains of Palestinian employment in Israel while reducing its negative effects on domestic production.

In Chapter 9, the question of the optimal trade regime in a future Palestinian state (research objective five) has been investigated. Compared to previous studies which mostly used a descriptive analysis, this thesis allows for the quantification of the implications of different trade regimes on the West Bank economy. The chapter uses the newly developed SAM with a detailed representation of the West Bank trade partners to analyse the effects of differentiated policies towards specific trade partners. The simulation results show that the elimination of tariffs on imports from all trade partners outperforms the other simulated trade regimes. Liberalising trade in the West Bank improves all macroeconomic indicators as compared to the *status quo* of a continued customs union with Israel. In contrast, introducing new tariffs on imports from Israel hurts the West Bank economy and generates an outcome that is worse than a continued customs union with Israel. Consequently, a sovereign Palestinian state may want to adopt a liberal and non-discriminatory trade regime. Adopting such a trade policy can diversify Palestinian trade and reduce trade diversion, which is caused by the current customs union.

The results also show that eliminating the in-quota tariffs hardly affects the import of agricultural and food products, as the import quotas become binding and the domestic agricultural and food sector are shielded against import competition. However, doubling the import quotas improves consumer welfare, though it reduces the welfare of producers of those products. The net effect is a welfare gain in the West Bank. This finding highlights the trade-off between food sovereignty and net welfare improvements through trade.

The assessment of alternative trade regimes, assuming that after the exit from the customs union with Israel, the West Bank concludes a preferential trade agreement with Israel or enters a Greater Arab customs union, all yield moderate results compared to the scenario with the introduction of high (most-favoured-nation) tariffs on imports from Israel. However, both scenarios are worse than the *status quo* and hence are less desirable than a continued customs union with Israel. This highlights the importance of "free" trade with Israel for the West Bank economy as, from both economic and geographic perspectives, Israel is the main outlet for Palestinian trade. Finally, the results show that monetary policies have a substantial impact on the magnitude of trade policy effects.

10.2. Contributions to the state of knowledge

The contributions of this thesis to the state of knowledge are threefold: i) the construction of a SAM for the West Bank; ii) the assessment of the implications of different labour market conditions for simulation results; and iii) the extension of trade and production modules in CGE models to capture the particularities of trade and labour markets in conflict-affected regions, especially the West Bank, and the modelling of multi-stage utility functions to represent household preferences.

The West Bank SAM is a contribution to the global effort to build reliable databases that can serve as benchmarks for simulation models and inform policy decisions. This SAM is highly disaggregated and flexible to allow its future users to adopt alternative classifications depending on the research question. An Input-Output Table is derived from the SAM and is submitted to the Global Trade Analysis Project (GTAP) to be included in their global database. Hence, it will be available to the international community of researchers to address policy-relevant questions in the West Bank.

In the process of compiling the SAM, this thesis takes proper account of the remuneration of labour for the self-employed. Restricting the labour share of value added to the compensation of employees suffers from a major limitation because it omits the contribution of the self-employed to labour income. In this thesis, a combination of the Gindling *et al.* (2016) and the Young (1995) approaches is adopted. First, the self-employed are identified from the labour force survey database and are matched with wage-workers based on socioeconomic characteristics such as sector of employment, age, gender, and education level. Then, wages for the wage-workers are attributed to the self-employed plus the earning premium estimated by Gindling *et al.* (2016).

The West Bank SAM, unlike most of the existing social accounting matrices recognises that households derive income from unincorporated capital. Household activity is often disregarded as it usually refers to small-scale, informal and non-market activities (Round, 2003). Household activity includes both family enterprises (which employ family members) and micro enterprises (which hire employees). The income earned by such an activity clearly represents both returns to labour and to capital. The extent to which earlier SAMs have taken proper consideration of household income from unincorporated capital is unclear in most cases. However, this problem is explicitly tackled in this thesis.

This thesis makes another contribution to knowledge by assessing – in Chapter 6 – the implications of different model specifications to depict the labour market conditions in conflict-affected regions, especially in the West Bank. The STAGE-2 model was used as a starting point. The technical tasks required to extend the production module and introduce these model specifications are described in Appendix 1. The results highlight that the assumptions embedded in each model specification have substantial effects on the simulation results. All the model specifications have their merits and demerits. Hence, the choice of a specification should be backed up with an economic theory, the empirical evidence of the market conditions to be captured, and the time horizon of the analysis.

In Chapter 8, this thesis innovates by adopting a nested utility function combining the benefits of LES and CES functions to depict households preferences with differentiated functional forms and achieve a greater flexibility in assigning elasticity of substitution at each stage of the nest. Although the use of multi-stage utility functions is not new, the combination of LES and CES functions has been rarely contemplated (Aragie *et al.*, 2017). The study results show how sensitive simulation results could be to the choice of the nested utility structure, which is demonstrated regarding the substitution of leisure and non-leisure commodities. Hence, the choice of a nested utility structure should be backed up with theory and empirical studies, especially with regard to which commodities are considered substitutes or complements.

In terms of modelling the trade relations in conflict-affected regions, this thesis combines several existing methods in an innovative way. The thesis – in Chapter 9 – explicitly accounted for a multi-trade partner set-up, the differentiation between large and small trade partners, and the presence of tariff-rate-quotas on agricultural and food products. These model specifications increased the relevance of the model for policy analysis.

10.3. Policy implications

The thesis shows that reducing barriers to the movement of goods, services and labour in conflict-affected regions has substantial economic implications, especially for the vulnerable party engaged in the conflict. In the case of the Palestinian-Israeli conflict, the applications conducted in this thesis contributed to the identification of administrative and political options for the Palestinian National Authority to regulate the labour markets and design an optimal trade regime.

The findings in Chapter 7 and Chapter 8 highlight that increasing Palestinian employment in Israel improves household welfare and can contribute to a more equal income distribution in the West Bank. While in the short-term the shock stimulates both consumption and production in the West Bank economy, in the long-term, it reduces economic growth by bidding up wages and reducing the competitiveness of the West Bank export industry. Seen the limited development options in the West Bank, it may be interesting for the Palestinian National Authority to seek an increased Palestinian employment in Israel in order to improve the welfare of Palestinian households, while simultaneously mitigating the negative effects on the domestic economy in the long-term.

In order to achieve this goal, the PNA could levy a tax on Palestinian workers employed in Israel. This tax will generate additional revenue for the PNA. With this revenue, incentives could be given to domestic employers to invest and upgrade their production technologies in order to restore their competitiveness in the international markets. The tax would also reduce the attractiveness of employment in Israel, keep some workers in the domestic market activities and limit the structural dependence on the Israeli labour market. By incentivising the private sector, employment opportunities would be generated in the domestic market and the eventual loss of employment in Israel, subsequent to the implementation of the tax, would be compensated by employment in the domestic market.

With respect to an optimal trade regime, this thesis points out that the West Bank would be better off with a liberal and non-discriminatory trade policy. The results show that Israel is likely to remain the dominant trade partner for the West Bank. Therefore, the Palestinian National Authority should seek the freest possible movement of goods and services between the West Bank and Israel. A preferential trade regime with Israel, assuming the introduction of moderate tariffs on imports/exports from/to Israel – though worse than the current *status quo* – is more desirable than trading with Israel under the most-favoured-nation trade regime. Though a greater integration of the West Bank, and Palestine as a whole, with the other Arab countries is important, it cannot be a substitute to the economic links with Israel, since Israel will remain – for both economic and geographic reasons – the main trade partner for the West Bank. The thesis results also show that the monetary policy adopted has strong implications for the magnitude of the effects of any trade regime. Subsequently, the Palestinian National Authority should seek the fullest control over its national currency and exchange rate in the future. Finally, the tariff-rate-quota system on agricultural and food products effectively shields the domestic sectors against import competition, but at the cost of consumer welfare. Hence, maintaining the system or changing the tariff-rate-quotas is a political decision between achieving a certain level of food sovereignty or taking advantage of the benefits of trade.

10.4. Limitations of the thesis and suggestions for future research

This thesis left some caveats that could be explored with future research endeavours.

With respect to the labour markets, the two applications conducted in Chapter 7 and Chapter 8 used the "best" available model specifications to represent the market conditions in the West Bank in relation to the time horizon of the analysis. However, as shown in Chapter 6, each of these model specifications has its demerits. The labour surplus specification is likely to overstate the effect of the simulated policy change on employment, absorption and welfare. The implicit assumption that labour has zero opportunity cost outside the SNA production is unlikely to hold as households derive welfare from the services produced by those activities outside the boundary (McDonald, 2018). Moreover the assumption that labour can enter the boundary at fixed wages is open to challenges, as the empirical evidence shows that wages increase together with the level of employment at least in the medium to long-term (Boeters and Savard, 2011).

The labour-leisure trade-off has the inconvenience of being inconsistent with involuntary unemployment. While it may be reasonable to assume for a normal economy that, in the long-term, labour has always the possibility to be either employed within the SNA boundary or be self-employed in the activities outside the boundary, in a troubled economy like that of the West Bank, involuntary unemployment is a structural problem that could persist even in the long-term. The Palestinian economy achieved a state close to full employment only during the years of the open borders policy between Israel and the Palestinian territories. The free movement of labour in the 70s and 80s, with the Israeli economy absorbing about one third of the Palestinian labour force, compensated for the small size of the domestic Palestinian economy to employ the relatively large and young labour force (Arnon and Bamya, 2007). However, this state of "free" movement into the Israeli market is unlikely to hold even in a final solution to the conflict. Therefore, the labour-leisure trade-off specification, by assuming no involuntary unemployment, is likely to understate the effect of the policy change on employment and absorption.

Given these insights, future research is needed to come up with a model specification that is consistent with standard economic theories, allows labour transfer across the production boundary while capturing the welfare changes generated outside the boundary, and accounts for involuntary unemployment.

With respect to the trade policy implemented in Chapter 9, in order to assess the isolated effects of various trade regimes in the West Bank, the analysis ignored some aspects that may affect the range of possibilities. The analysis did not account for any retaliation policy Israel may take against the West Bank, whether related to trade or to labour movement, if Palestine exits the current customs union. The assumption that everything else than the levels of tariffs remain as in the base (*ceteris paribus*) was applied. Hence, the benefits of removing the existing internal closures if Palestine gained sovereignty are not modelled, and the costs of keeping a customs administration at the borders are also not accounted for. Future research could address these questions in an isolated way to investigate their individual effects on the West Bank economy, and in a combined way to evaluate the net effect.

Finally, the applications conducted in this thesis focused on a particular conflict, and on the specificities of the West Bank economy. Hence, the conclusions cannot be generalised to other cases without caution. The debate on conflict and trade, including the movement of labour to supply services abroad, is very case-specific.

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APPENDICES

Appendix 1. Model modifications

The model described in Section 3.6 of Chapter 3 is modified in different ways to depict some special features of the Palestinian economy that are relevant for the four applications conducted in this thesis. The model modifications are related to the factor market, the production, consumption and trade modules. Each section of this appendix deals with one of the model modifications with all the technical details. The first section presents the modifications required to introduce a mobility function in the model, and the changes to the market clearing equations to depict the different specifications examined in Chapter 6. The second section deals with the modifications incorporated in the model code to extend the production module, in order to reflect the differentiated composition of the labour force in the West Bank. This extension is used across all four applications. The third section describes the model code for depicting households' preferences via a nested utility function, as used in Chapter 9. The fourth and last section shows the multi-trade partners specification used in all four applications. In this section the differentiated treatment applied to trade partners with small and large shares as well as the modelling of tariff-rate-quotas in a multi-trade partner context, used in Chapter 9, are also described.

1. Model modifications related to factor markets

1.1. Integration of a mobility function

The labour mobility function used in Chapter 6 and Chapter 8 allows labour to move between pools or pairs of market segments – i.e. labour employed in a block of sectors – based on a response elasticity and a wage ratio. This modelling approach was initially developed by McDonald and Thierfelder (2013) and was later extended by Flaig (2014).

For its implementation, a new set "$fmig$" and its alias "$fmig$p" are defined for factors that are assumed to be mobile. In a satellite account, the pairs of market segments between which a labour mobility is considered are defined. Every worker in a market segment has the possibility to move, meaning that labour mobility depends on the factor supply in the base period. The mobility function is governed by a wage ratio ($WMOBRATIO$) as defined in equation [MF1], where FD is the demand for factor $fmig$ in activity a, WF the average wage rate for factor $fmig$, and $WFDIST$ an activity specific factor "efficiency" parameter capturing differences in the observed productivities of factor $fmig$ in different activities.

The mobility function is activated by a change in relative wages as defined in Equation [MF2] where $FSIM$ is the variable recording the number of workers moving from $fmig$ to

$fmig$. $FSI0$ is the initial pool of labour f supplied by institution $insw$, $WMOBRATIO$ is the wage ratio between wages for $fmig$ and $fmigp$ after the shock and $WMOBRATIO0$ is the wage ratio in the base period.

When the wage for factor $fmig$ increases relative to factor $fmigp$, the ratio $WMOBRATIO$ diverges from $WMOBRATIO0$ and factor mobility from $fmig$ to $fmigp$ takes place. The intensity of the mobility is governed by a response elasticity ($etamig$), which is defined for each pair of market segments and captures the influence of structural features such as transaction costs and efficient factor markets on the labour mobility.

Equation [MF3] avoids the creation of additional factors by ensuring that for each unit of factor moved from one segment only one unit of factor is created in the paired segment. This equation also determines the number of workers who stay in their market segment. The new pool of factor fmig supplied by each institution is defined by the equation [MF4].

Name	Equation	Variable
MF1	$WMOBRATIO_{fmig,fmigp,insw} = \dfrac{\dfrac{\sum_a(WF_{fmigp} * WFDIST_{fmigp,a} * FD_{fmigp,a})}{\sum_a FD_{fmigp,a}}}{\dfrac{\sum_a(WF_{fmig} * WFDIST_{fmig,a} * FD_{fmig,a})}{\sum_a FD_{fmig,a}}}$	$WMOBRATIO$
MF2	$FSIM_{fmig,fmigp,insw} = FSI0_{insw,fmig} * \left(\dfrac{WMOBRATIO_{fmig,fmigp,insw}}{WMOBRATIO0_{fmig,fmigp,insw}}\right)^{etamig_{fmig,fmigp,insw}}$	$FSIM$
MF3	$FSIM_{fmig,fmigp,insw} = FSI_{insw,fmig} - \sum_{fmigp} FSIM_{fmig,fmigp,insw}$	$FSIM$
MF4	$FSI_{insw,fmig} = \sum_{fmigp} FSIM_{fmig,fmigp,insw}$	FSI

1.2. Factor market clearing equations

The market clearing equation in the STAGE-2 model (Equation FMC1) equates the supply of factor f (FS_f) to its demand across all activities ($FD_{f,a}$). In Chapter 6, four market clearing equations that involve modifying the initial equation are contemplated.

To model the market condition with a fixed supply of labour, while allowing for labour movement between the West Bank and Israeli markets, a new parameter $fd\_w_{f,w}$ is introduced to capture the demand for factor f in foreign region w (Equation [FMC2]).

For modelling the market condition with a surplus labour, a new variable ($UNEMP_f$) is added to the equation to capture the pool of factor not employed within the production boundary (Equation [FMC3]). Unemployment is defined as an inequality (Equation [FMC4]), which allows the unemployment of each factor to change on the condition that the unemployment variable is strictly positive. If there is unemployment of a factor, i.e. if that factor belongs to set $UEF(f)$, then the real wage rate for that factor is fixed.

Under the assumption of an upward-sloping curve, Equation [FMC3] still holds, but unemployment is no longer defined as an inequality. It is rather a log-linear equation (Equation [FMC5]) that allows unemployment of each factor to change depending on a labour supply elasticity and changes in the real wage. In equation FMC5, TYF are factor taxes, CPI the consumer price index, α_f^0 the calibrated intercept of the function and α_f^1 the supply curve elasticity that is country-specific and has to be estimated separately using labour force survey data and an appropriate estimation procedure.

In the market clearing equation for a labour-leisure trade-off specification, the equation is further modified to reflect the use of labour in activities outside the production boundary (Equation [FMC6]). Note that in Equation FMC6, factor demand $FD_{f,a}$ is only aggregated over the set $alein$, which refers to activities within the production boundary of the domestic market. $FSIE_{insw,f}$ is the pool of factor f supplied by institution $insw$ to activities outside the boundary. The demand of labour in activities outside the production boundary is defined in the Equation [FMC7], where the mapping (map_hh_alei) pairs the leisure activities $alei$ with households (hh), while the set $alei$ refers to leisure activities.

Name	Equation	Variable
FMC1	$FS_f = \sum_a FD_{f,a}$	FS_f
FMC2	$FS_f = \sum_a FD_{f,a} + \sum_w fd\_w_{f,w}$	FS_f
FMC3	$FS_f = \sum_a FD_{f,a} + \sum_w fd\_w_{f,w} + UNEMP_f$	FS_f
FMC4	$UNEMP_f > 0 \qquad \forall UEF(f)$	$UNEMP_f$
FMC5	$ln\left(\frac{WF_f * (1 - TYF_f)}{CPI}\right) = \alpha_f^0 + \left(\alpha_f^1 * ln\left(\frac{UNEMP_f}{FS_f}\right)\right) \qquad \forall UEF(f)$	$UNEMP_f$
FMC6	$FS_f = \sum_{alein} FD_{f,a} + \sum_w fd\_w_{f,w} + \sum_{insw} FSIE_{insw,f} \qquad \forall alein_a \; and \; f_{ff}$	FS_f
FMC7	$FSIE_{insw,f} = \sum_{a\$map\_hh\_alei(insw,a)} FD_{f,a} \qquad \forall alei_a \; and \; f_{ff}$	$FSIE_{insw,f}$

2. Production module

2.1. Production module in the STAGE-2 model

The STAGE-2 model allows modelling multiple-product activities. Equation X1 expresses the composite price of output (PX_a) by activity a as a weighted average of the prices paid for the commodities produced by each activity ($PXAC_{a,c}$). The weights are the quantities of each commodity produced by each activity ($ioqxacqx_{a,c}$). The model specifies production as a three-stage process, in which each stage can be formulated as a CES or Leontief technology. At the top level of the nest, Equation [X2] expresses the definition of PX_a if a CES technology is imposed. Accordingly, PX_a is a volume weighted aggregate of the prices of the inputs after deducing the *ad valorem* production taxes (TX_a). The inputs in the top nest are the aggregate of factors used (value added) and the aggregate of commodities used (intermediate inputs).

In Equation [X3], the price of aggregate intermediate inputs ($PINT_a$) is defined as the weighted sum of the purchaser prices of individual commodities used as inputs (PQD_c), where the weights are the input coefficients of demand for commodity c by activity a ($ioqtdqd_{c,a}$). With the CES technology, the quantity of output (QX_a) of activity a is a volume-weighted average of value added (QVA_a) and aggregate intermediate input ($QINT_a$) (Equation [X5]), where δ_a^x is the share parameter, ρ_a^{cx} the substitution parameter and ADX the efficiency variable. The efficiency variable is defined in Equation [X4] with an adjustment mechanism for additive ($DADX$) and multiplicative ($ACXADJ$) scaling of the activity efficiency. The optimal ratio of $QINT_a$ to QVA_a is defined by the first order conditions for profit maximisation (Equation [X6]), considering relative prices of value added (PVA_a) and aggregate intermediate input ($PINT_a$).

Equations [X7] express the case if a Leontief technology is assumed in the top nest. Both the value added and the aggregate intermediate inputs are fixed volume shares of output. The choice of the top level aggregation is controlled by the membership in either the set aqx for activities with CES aggregation function, or in the set $aqxn$ for activities with a Leontief aggregation function.

Production Block – Top Level

Name	Equation	Variable
X1	$PX_a = \sum_c ioqxacqx_{a,c} * PXAC_{a,c}$	PX_a
X2	$PX_a * (1 - TX_a) * QX_a = (PVA_a * QVA_a) + (PINT_a * QINT_a)$	PVA_a
X3	$PINT_a = \sum_c ioqtdqd_{c,a} * PQD_c$	$PINT_a$
X4	$ADX_a = \left((adx_a + dabadx_a) * ADXADJ\right) + (DADX * adx01_a)$	ADX_a
X5	$QX_a = ADX_a * \left(\left(\delta_a^x * QVA_a{}^{-\rho_a^{cx}}\right) + \left((1 - \delta_a^x) * QINT_a{}^{-\rho_a^{cx}}\right)\right)^{-\frac{1}{\rho_a^{cx}}} \quad \forall\, aqx_a$	QX_a
X6	$\frac{QVA_a}{QINT_a} = \left[\frac{PINT_a}{PVA_a} * \frac{\delta_a^x}{(1 - \delta_a^x)}\right]^{\frac{1}{(1+\rho_a^{cx})}} \quad \forall\, aqx_a$	$QINT_a$
X7a	$QINT_a = ioqxacqx_{a,c} * QX_a \quad \forall\, aqx_a$	$QINT_a$
X7b	$QVA_a = ioqvaqx_a * QX_a \quad \forall\, aqxn_a$	QVA_a

The second level of the nest has two arms. In the first arm, the value added is an aggregation of the set $f2$ (factors in the second level of the nest), which consist of capital, land and labour. This aggregation is defined in Equation [X9] where $\delta_{f2,a}^{va}$ is the share parameter, ρ_a^{va} the elasticity parameter and $ADVA_a$ the efficiency variable which is defined in Equation [X8] with both additive ($DADV$) and multiplicative ($ADVAADJ$) adjustment parameters. The optimal ratio of the different factors $f2$ is defined by the first order conditions for profit maximisation (Equation [X10]) which determine the wage rate of factor $f2$ in a specific activity a. That wage rate is composed of the average wage rate for factor $f2$ (WF_{f2}) and a factor and activity specific efficiency parameter ($WFDIST_{f2,a}$). The ratios $WFDIST_{f2,a}$ are included in the equation to allow for non-homogenous factors, and are derived from the first order conditions for profit maximisation as equalities between the wage rates for each factor in each activity and the values of the marginal products of those factors in each activity. The actual return to factor is adjusted for the factor use taxes ($TF_{f2,a}$).

In the second arm of the nest (Equation [X11]), the aggregate intermediate input is defined by a Leontief technology where the intermediate demand ($QINTD_c$) of commodity c is a fixed volume share of the aggregate intermediate input ($QINT_a$) demanded by activity a. The weights are the input coefficients of demand for commodity c by activity a ($ioqtdqd_{c,a}$).

Production Block – second level

Name	Equation	Number of equations	Variable
X8	$ADVA_a = \big((adva_a + dabadva_a) * ADVAADJ\big) + (DADVA * adva01_a)$	a	$ADVA_a$
X9	$QVA_a = ADVA_a * \left[\sum_{f2} \delta_{f2,a}^{va} * \left(ADFD_{f2,a} * FD_{f2,a}\right)^{-\rho_a^{va}}\right]^{-\frac{1}{\rho_a^{va}}} \quad \forall\ \rho_a^{va}$	a	QVA_a
X10	$WF_{f2} * WFDIST_{f2,a} * \left(1 + TF_{f2,a}\right) = PVA_a * QVA_a * \left(\sum_{f2} \delta_{f2,a}^{va} * \left(ADFD_{f2,a} * FD_{f2,a}\right)^{-\rho_a^{va}}\right)^{-1} * \delta_{f2,a}^{va} * \left(ADFD_{f2,a}\right)^{-\rho_a^{va}} * \left(FD_{f2,a}\right)^{(-\rho_a^{va}-1)}$	f2*a	$FD_{f2,a}$
X11	$QINTD_c = \sum_a ioqtdqd_{c,a} * QINT_a$	c	$QINTD_c$

In the third level of the nest, the aggregate labour $f2ag$, i.e. aggregate factor at level 2, is formed by factors $f3$ (factors in level 3), which are individual labour factors. Equation [X12] defines the aggregation function with $\delta_{f2,f3,a}^{fd}$ as the share parameter, $\rho_{f,a}^{fd}$ the substitution parameter, and $ADFAG_{f,a}$ the efficiency parameter. The associated first order conditions for profit maximisation are expressed in Equation [X13]. They define the wage rate for specific factor used by specific activity as a composite of the average wage rate for that factor (WF_{f2}) and the factor and activity efficiency parameter ($WFDIST_{f2,a}$). The actual return to factor is adjusted for the factor use taxes ($TF_{f2,a}$).

Production Block – Third level

Name	Equation	Variable
X12	$FD_{f2ag,a} = ADFAG_{f2ag,a} * \left[\sum_{f3} \delta_{f2ag,f3,a}^{fd} * \left(FD_{f3,a}\right)^{-\rho_{f2ag,a}^{fd}}\right]^{-\frac{1}{\rho_{f2ag,a}^{fd}}} \quad \forall FD_{f2ag,a}$	$FD_{f2ag,a}$
X13	$WF_{f3} * WFDIST_{f3,a} * \left(1 + TF_{f3,a}\right) = WF_{f2ag} * WFDIST_{f2ag,a} * \left(1 + TF_{f2ag,a}\right) * FD_{f2ag,a} * \left(\sum_{f3} \delta_{f2ag,f3,a}^{fd} * \left(FD_{f3,a}\right)^{-\rho_{f2ag,a}^{fd}}\right)^{-1} * \delta_{f2ag,f3,a}^{fd} * \left(FD_{f3,a}\right)^{(-\rho_{f2ag,a}^{fd}-1)}$	$FD_{f3,a}$

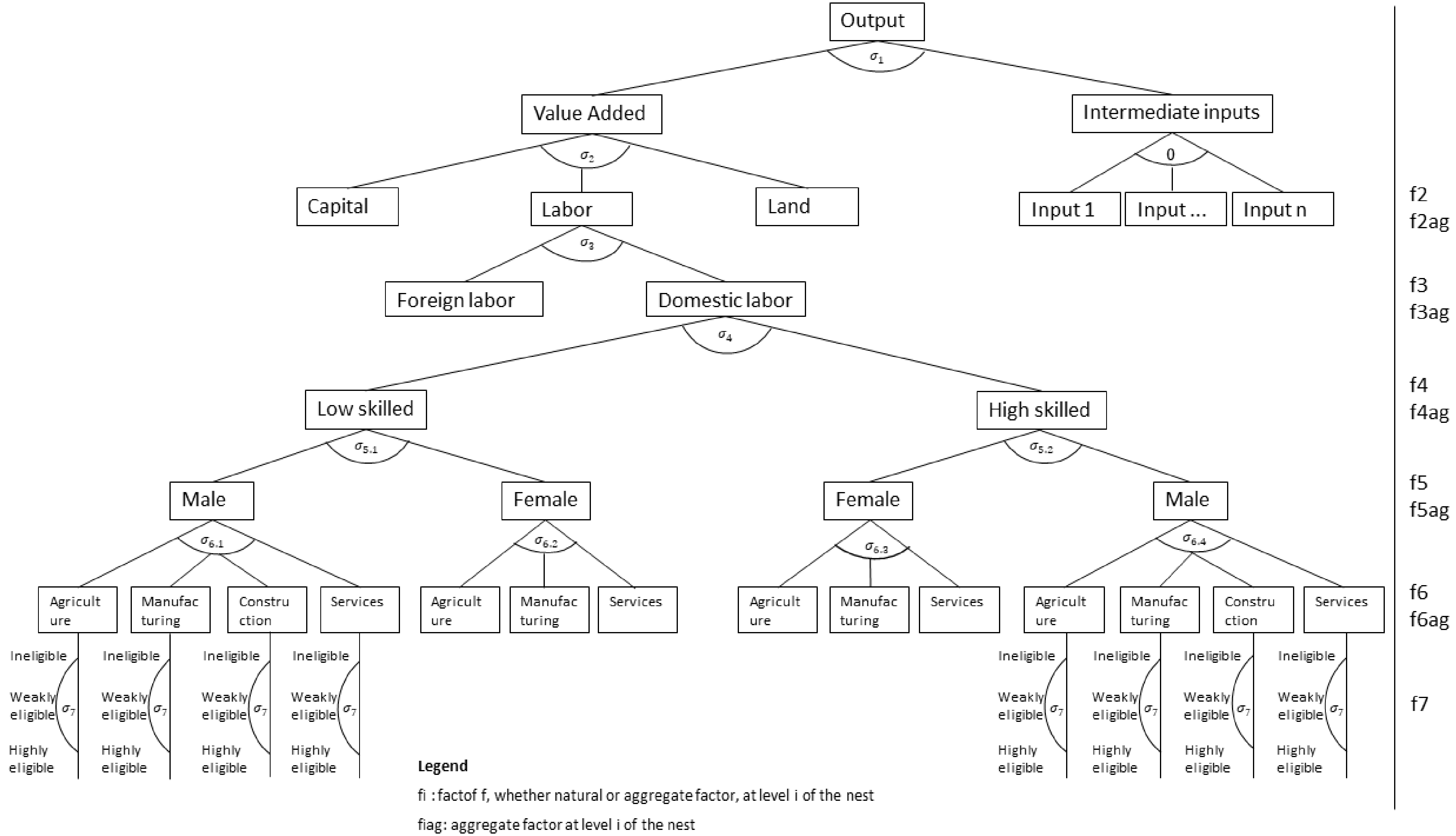
2.2. Model extension

The production module used in the first application is extended from a three-stage process to a seven-stage process as displayed in Figure A1. Accordingly, in the top level of the nest, output of each activity is formed by two aggregates: one for factors (value added) and one for commodities used as inputs (aggregate intermediate input). The second level of the nest has two branches. In the first branch, the aggregate intermediate input is composed of demand for individual commodities in fixed proportions. In the second branch, value added is an aggregate of the set $f2$, consisting of capital, land and aggregate labour.

Aggregate labour is modelled as a multi-stage aggregate to reflect the composition of the Palestinian labour force. Hence, in the third level of the nest, the aggregate labour ($f2ag$) is formed of set $f3$, composed of foreign and domestic labour employed in the Palestinian economy. In the fourth level, demand for domestic labour ($f3ag$) is a CES aggregate of set $f4$ factors, which are low and high-skilled labour. In the fifth level, both low and high-skilled labour ($f4ag$) are CES functions of set $f5$, which includes male and female workers. The categories of male workers ($f5ag$) are aggregates of set $f6$ factors, which classifies workers into ineligible, weakly eligible and highly eligible to receive a work permit in Israel.

The models used in the first and third applications further extend the nesting structure with female labour ($f5ag$) considered as an aggregate of $f6$ factors who are female workers employed in three blocks of sectors: agriculture, manufacturing and services. The three branches of male ineligible, weakly and highly eligible ($f6ag$) are themselves aggregates of set $f7$ factors, which include workers employed in four blocks of sectors: agriculture, manufacturing, construction and services.

Figure A1. Nesting structure in the production module



Source: Own illustration

This nesting structure is implemented in the model by adjusting the sets and set mappings accordingly. Four production levels are added to the initial three of the STAGE-2 model with the equation shown in the following equations ([X14] - [X21].

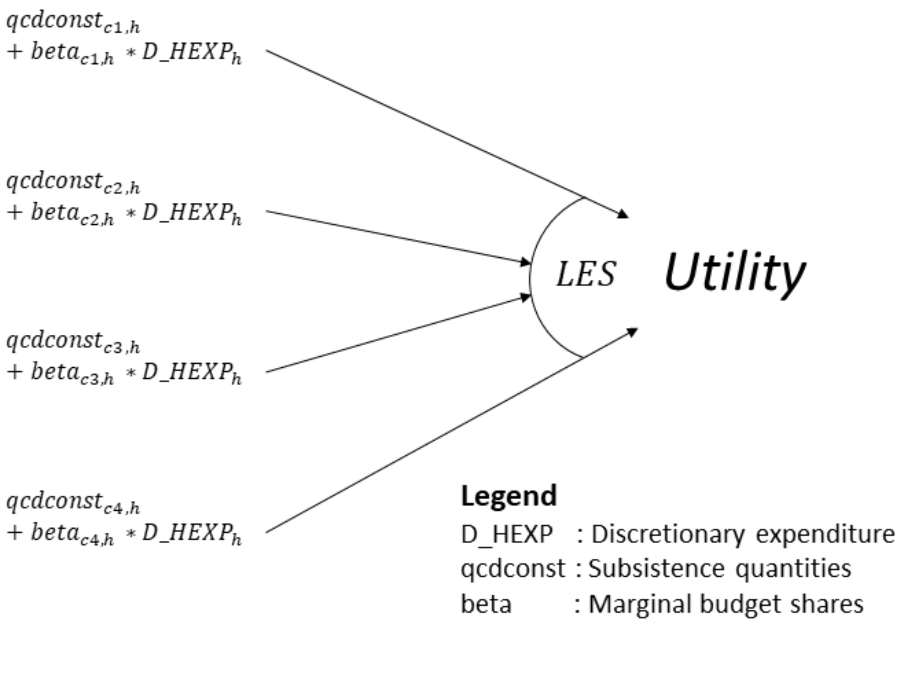
Name	Equation	Variable
X14	$FD_{f3ag,a} = ADFAG_{f3ag,a} * \left[\sum_{f4} \delta^{fd}_{f3ag,f4,a} * \left(FD_{f4,a}\right)^{-\rho^{fd}_{f3ag,a}}\right]^{-\frac{1}{\rho^{fd}_{f3ag,a}}} \quad \forall FD_{f3ag,a}$	$FD_{f3ag,a}$
X15	$WF_{f4} * WFDIST_{f4,a} * \left(1 + TF_{f4,a}\right) = WF_{f3ag} * WFDIST_{f3ag,a} * \left(1 + TF_{f3ag,a}\right) * FD_{f3ag,a} * \left(\sum_{f4} \delta^{fd}_{f3ag,f4,a} * \left(FD_{f4,a}\right)^{-\rho^{fd}_{f3ag,a}}\right)^{-1} * \delta^{fd}_{f3ag,f4,a} * \left(FD_{f4,a}\right)^{(-\rho^{fd}_{f3ag,a}-1)}$	$FD_{f4,a}$
X16	$FD_{f4ag,a} = ADFAG_{f4ag,a} * \left[\sum_{f5} \delta^{fd}_{f4ag,f5,a} * \left(FD_{f5,a}\right)^{-\rho^{fd}_{f4ag,a}}\right]^{-\frac{1}{\rho^{fd}_{f4ag,a}}} \quad \forall FD_{f4ag,a}$	$FD_{f4ag,a}$
X17	$WF_{f5} * WFDIST_{f5,a} * \left(1 + TF_{f5,a}\right) = WF_{f4ag} * WFDIST_{f4ag,a} * \left(1 + TF_{f4ag,a}\right) * FD_{f4ag,a} * \left(\sum_{f5} \delta^{fd}_{f4ag,f5,a} * \left(FD_{f5,a}\right)^{-\rho^{fd}_{f4ag,a}}\right)^{-1} * \delta^{fd}_{f4ag,f5,a} * \left(FD_{f5,a}\right)^{(-\rho^{fd}_{f4ag,a}-1)}$	$FD_{f5,a}$
X18	$FD_{f5ag,a} = ADFAG_{f5ag,a} * \left[\sum_{f6} \delta^{fd}_{f5ag,f6,a} * \left(FD_{f6,a}\right)^{-\rho^{fd}_{f5ag,a}}\right]^{-\frac{1}{\rho^{fd}_{f5ag,a}}} \quad \forall FD_{f5ag,a}$	$FD_{f5ag,a}$
X19	$WF_{f6} * WFDIST_{f6,a} * \left(1 + TF_{f6,a}\right) = WF_{f5ag} * WFDIST_{f5ag,a} * \left(1 + TF_{f5ag,a}\right) * FD_{f5ag,a} * \left(\sum_{f6} \delta^{fd}_{f5ag,f6,a} * \left(FD_{f6,a}\right)^{-\rho^{fd}_{f5ag,a}}\right)^{-1} * \delta^{fd}_{f5ag,f6,a} * \left(FD_{f6,a}\right)^{(-\rho^{fd}_{f5ag,a}-1)}$	$FD_{f6,a}$
X20	$FD_{f6ag,a} = ADFAG_{f6ag,a} * \left[\sum_{f7} \delta^{fd}_{f6ag,f7,a} * \left(FD_{f7,a}\right)^{-\rho^{fd}_{f6ag,a}}\right]^{-\frac{1}{\rho^{fd}_{f6ag,a}}} \quad \forall FD_{f6ag,a}$	$FD_{f6ag,a}$

X21	$WF_{f7} * WFDIST_{f7,a} * (1 + TF_{f7,a}) = WF_{f6ag} * WFDIST_{f6ag,a} * (1 + TF_{f6ag,a}) * FD_{f6ag,a} * \left(\sum_{f7} \delta^{fd}_{f6ag,f7,a} * (FD_{f7,a})^{-\rho^{fd}_{f6ag,a}} \right)^{-1} * \delta^{fd}_{f6ag,f7,a} * (FD_{f7,a})^{(-\rho^{fd}_{f6ag,a}-1)}$	$FD_{f7,a}$

3. Nested utility functions

The utility function in the STAGE-2 model incorporates a single stage LES function of the form shown in Figure A2. While this specification has the advantage of splitting subsistence consumption from discretionary consumption, it assumes households to require a minimum level of consumption for individual commodities. Moreover, it assumes all commodities to be gross complements (De Boer and Missaglia, 2006). To replicate households' preferences it may be more reasonable to assume that households define subsistence levels of consumption at the level of broad groups of commodities (food, manufactured goods and services), and within each broad group that they can substitute individual commodities (Aragie *et al.*, 2017). To achieve such a differentiation, a multi-stage utility function is needed and a combination of LES and CES functions can provide a high flexibility in setting substitution elasticities.

Figure A2. Single stage LES utility function



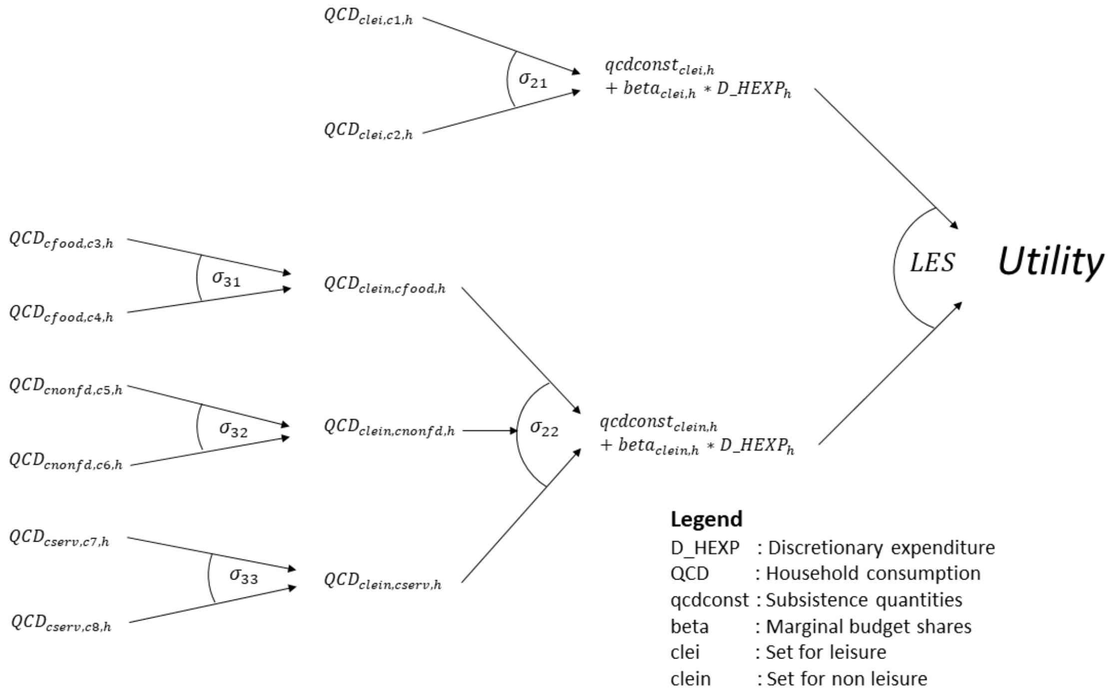
Source: Own illustration

In Chapter 8, a three-stage nested utility of the form presented in Figure A3 function is used. At the top of the nesting structure, an LES function is considered with two broad groups of commodities. The use of the LES function at the top of the nesting structure defines the subsistence levels of consumption over two broad groups of commodities. The choice of the groups that enter the LES nest should be based on empirical studies.

At the intermediate level, a CES function is used to differentiate the individual components making up each of the two broad groups of commodities. At the lowest level, each of the three aggregates at the intermediate level are composed of individual commodities.

The nesting structure used in Chapter 8 is generalised and can be further extended according to the modeller's needs.

Figure A3. Three-stages LES-CES utility functions



Source: Own illustration

The initial equation [UF1] that determines household utility is replaced by six equations. In the initial equation [UF1], the single-stage LES function defines household utility over individual or natural commodity demands (QCD_c), for which there are subsistence consumption ($qcdconst_{c,h}$) and marginal budget shares ($\beta_{c,h}$) of discretionary consumption expenditures ($HEXP_h$), subject to consumer prices (PQD_c) including the value added taxes (TV_c).

In the nested utility function, [UF1] is replaced by [UF2], which defines household utility over broad groups of commodity demands ($QCD_{c2ag,h}$). For these broad groups of commodities, there are specific subsistence consumption volumes ($qcdconst_{c2ag,h}$) and marginal budget shares of discretionary consumption expenditures ($\beta_{c2ag,h}$). Note that the prices of the broad groups of commodities ($PQCD_{c2ag,h}$) are indexed on both the aggregate commodity $c2ag$, and the household group, h, because the mix of natural commodities in each broad group is household-specific.

At the intermediate level, Equation [UF3] defines the formation of the broad groups of commodities (set $c2ag$) over a mix of aggregate and natural commodities (set $c3$). $\delta^{qcd}_{c2ag,c3,h}$ measures the expenditure share for spending on each member of the set $c3$, $\rho^{qcd}_{c2ag,h}$ is the substitution parameter between the members of the set $c3$, and $ACAG_{c2ag,h}$ is a shift parameter.

Two first order conditions are associated with this maximisation problem. Equation [UF4.1] defines the optimal prices for members of the set $c3$ that are aggregate commodities ($c3a$), while [UF4.2] defines the optimal prices for those members of the set $c3$ that are "natural"[23] commodities ($c3n$). In both cases the optimal prices of commodity $c3$ ($PQCD_{c3,h}$ if $c3a$ and PQD_{c3} if $c3n$) is a composite of the average price of the broad commodity ($PQCD_{c2ag,h}$), weighted by the quantities of the respective commodity $c3$ ($QCD_{c3,h}$). In [UF4.2], the optimal price of commodity $c3$ (PQD_{c3}) is adjusted for the value added tax (TV_{c3}).

At the lowest level of the nesting structure, Equation [UF5] defines the formation of the aggregate commodities in the set $c3ag$ over natural commodities (set $c4$).). $\delta^{qcd}_{c3ag,c3,h}$ measures the expenditure share for spending on each member of the set $c4$, $\rho^{qcd}_{c3ag,h}$ the substitution parameter between the members of set $c4$, and $ACAG_{c3ag,h}$ is a shift parameter. Since the set $c4$ is only composed of natural commodities, only one first order condition is required to define the optimal prices of commodities in the set $c4$. Equation [UF6] defines the optimal prices of natural commodities in the set 4 (PQD_{c4}) as a composite of the average price of the aggregate commodity ($PQCD_{c3,h}$), weighted by the quantities of the respective commodity $c4$ ($QCD_{c4,h}$) and adjusted for the value added tax (TV_{c4}).

[23] A commodity is said "natural" when it is not an aggregate of other commodities, which are used in the nesting structure.

Name	Equation	Variable
UF1	$PQD_c * QCD_c * (1 + TV_c) = \left(PQD_c * qcdconst_{c,h} * (1 + TV_c)\right) + \beta_{c,h} * \left(HEXP_h - \sum_{cp} \left(PQD_{cp} * qcdconst_{cp,h} * (1 + TV_{cp})\right)\right)$	QCD_c
UF2	$PQCD_{c2ag,h} * QCD_{c2ag,h} = \left(PQCD_{c2ag,h} * qcdconst_{c2ag,h}\right) + \beta_{c2ag,h} * \left(HEXP_h - \sum_{c2agp} \left(PQD_{c2agp} * qcdconst_{c2agp,h}\right)\right)$	$QCD_{c2ag,h}$
UF3	$QCD_{c2ag,h} = ACAG_{c2ag,h} * \left[\sum_{c3} \delta^{qcd}_{c2ag,c3,h} * \left(QCD_{c3,h}\right)^{-\rho^{qcd}_{c2ag,h}}\right]^{-\frac{1}{\rho^{qcd}_{c2ag,h}}} \quad \forall QCD_{c2ag,h}$	$QCD_{c3,h}$
UF4.1	$PQCD_{c3,h} = PQCD_{c2ag,h} * QCD_{c2ag,h} * \left(\sum_{c3} \delta^{qcd}_{c2ag,c3,h} * \left(QCD_{c3,h}\right)^{-\rho^{qcd}_{c2ag,h}}\right)^{-1} * \delta^{qcd}_{c2ag,c3,h} * QCD_{c3,h}{}^{\left(-\rho^{qcd}_{c2ag,h}-1\right)} \quad \forall c3a$	$PQCD_{c3,h}$
UF4.1	$PQD_{c3} * (1 + TV_{c3}) = PQCD_{c2ag,h} * QCD_{c2ag,h} * \left(\sum_{c3} \delta^{qcd}_{c2ag,c3,h} * \left(QCD_{c3,h}\right)^{-\rho^{qcd}_{c2ag,h}}\right)^{-1} * \delta^{qcd}_{c2ag,c3,h} * QCD_{c3,h}{}^{\left(-\rho^{qcd}_{c2ag,h}-1\right)} \quad \forall c3n$	PQD_{c3}
UF5	$QCD_{c3ag,h} = ACAG_{c3ag,h} * \left[\sum_{c4} \delta^{qcd}_{c3ag,c4,h} * \left(QCD_{c4,h}\right)^{-\rho^{qcd}_{c3ag,h}}\right]^{-\frac{1}{\rho^{qcd}_{c3ag,h}}} \quad \forall QCD_{c3ag,h}$	$QCD_{c4,h}$
UF6	$PQD_{c4} * (1 + TV_{c4}) = PQCD_{c3ag,h} * QCD_{c3ag,h} * \left(\sum_{c4} \delta^{qcd}_{c3ag,c4,h} * \left(QCD_{c4h}\right)^{-\rho^{qcd}_{c3ag,h}}\right)^{-1} * \delta^{qcd}_{c3ag,c4,h} * QCD_{c4,h}{}^{\left(-\rho^{qcd}_{c3ag,h}-1\right)} \quad \forall c4$	PQD_{c4}

4. Trade block

4.1. Trade relationships in STAGE-2

The STAGE-2 model incorporates a single foreign account. It provides a treatment for product differentiation between the domestic and foreign markets (Armington assumption). Accordingly, it distinguishes between the supply to the domestic and export markets as well as the demand for domestic and imported commodities. On the export side, the domestic price of export (PE_c) is defined in Equation [E1] as the product of the world market price of exports (PWE_c) and the exchange rate (ER), after subtraction of the export taxes (TE_c).

Equation [E1] only applies to commodities that are exported, i.e. those which are member of the set ce. The trade and transport margins associated with the exports are included in the form of prices per unit margin service (PTT_m). The world market price is declared as a variable which can be fixed to reflect the small country assumption, but can also be flexible to relax this assumption.

The differentiation between domestic and export supply is modelled with a CET function [E2] where γ_c is the share parameter, ρ_c^t the elasticity parameter and at_c the efficiency parameter. The associated first order conditions [E3] determine the optimal allocation of domestic output (QXC_c) between domestic demand (QD_c) and export supply (QE_c). The optimal ratios of export to domestic demand are defined by the relative prices of exported (PE_c) and domestically supplied (PD_c) commodities. These conditions are defined for commodities that are both demanded domestically (cd) and exported (ce).

In case a commodity is supplied to the domestic market but it is not exported, the domestic demand for domestic supply is equal to the total output [E4]. If a commodity is exported but has no domestic demand, the export supply equals the total output [E4]. Equation [E5] defines a downward-sloping export demand curve that reflects the case of a country being a large exporter of a particular commodity.

Trade Block – Exports

Name	Equation	Variable
E1	$PE_c = PWE_c * ER * (1 - TE_c) - \sum_m \left(ioqttqe_{m,c} * PTT_m\right) \quad \forall\, ce_c$	PE_c
E2	$QXC_c = at_c * \left(\gamma_c * QE_c^{\rho_c^t} + (1 - \gamma_c) * QD_c^{\rho_c^t}\right)^{\frac{1}{\rho_c^t}} \quad \forall\, ce_c \ and\ cd_c$	QD_c
E3	$QE_c = QD_c \left[\frac{PE_c}{PD_c} * \frac{(1 - \gamma_c)}{\gamma_c}\right]^{\frac{1}{(\rho_c^t - 1)}} \quad \forall\, ce_c\ and\ cd_c$	QE_c
E4	$QXC_c = QE_c + QD_c \quad \forall\,(cd_c\ AND\ cen_c)\ OR\ (cdn_c\ AND\ ce_c)$	
E5	$QE_c = econ_c * \left(\frac{PWE_c}{pwse_c}\right)^{\eta_c} \quad \forall\, ced_c$	

The domestic prices of imports are obtained by converting the world market prices (PWM_c) into the domestic currency, using the exchange rate (ER), and after adding the tariffs (TM_c) (see equation [M1]). The product differentiation between demand for domestically produced commodities (QD_c) and demand for imported commodities (QM_c) is implemented with a CES function as defined in Equation M2 where δ_c is the share parameter, ρ_c^c the elasticity parameter and ac_c the efficiency parameter. Equation [M2] is defined for commodities for which there is both a domestic and import demand. Equation [M3] states the first order conditions that determine the optimal ratio between domestically supplied commodities and imported commodities. This optimal ratio is determined by the relative prices of imports (PM_c) and domestically supplied commodities (PD_c). For commodities, that are only imported and not domestically supplied, the total supply (QQ_c) is equal to the import quantity. Similarly, for commodities that are not imported, the total supply is equal to the domestic supply, as defined by equation [M4].

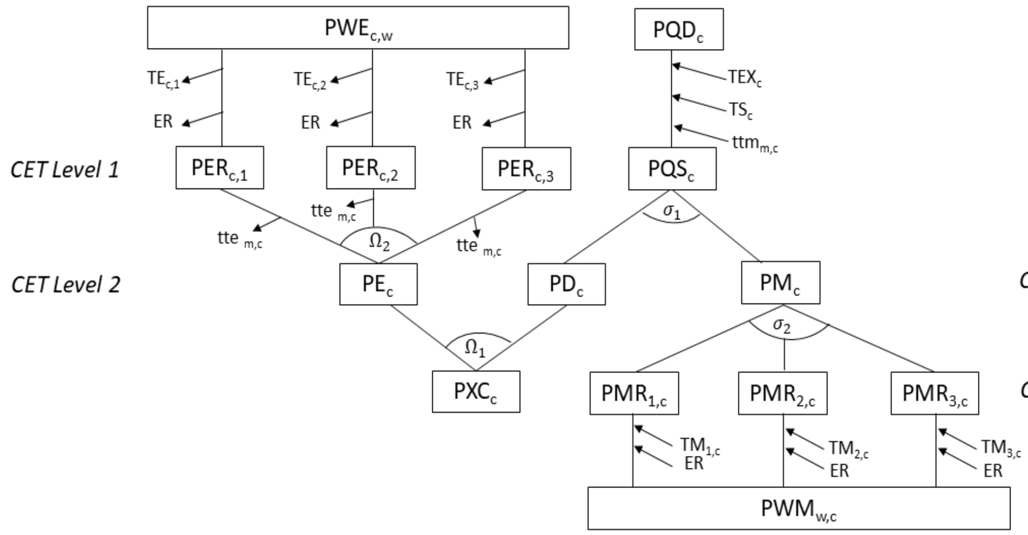
Trade Block – Imports

Name	Equation	Variable
M1	$PM_c = PWM_c * ER * (1 + TM_c) \quad \forall\, cm_c$	PM_c
M2	$QQ_c = ac_c * \left(\delta_c * QM_c^{-\rho_c^c} + (1 - \delta_c) * QD_c^{-\rho_c^c}\right)^{-\left(\frac{1}{\rho_c^c}\right)} \quad \forall\, cm_c \; AND \; cx_c$	QM_c
M3	$QM_c = QD_c * \left[\frac{PD_c}{PM_c} * \frac{\delta_c}{1 - \delta_c}\right]^{\frac{1}{\rho_c^c + 1}} \quad \forall\, cm_c \; AND \; cx_c$	PD_c
M4	$QQ_c = QM_c + QD_c \quad \forall\, (cmn_c \; AND \; cx_c) \; OR \; (cxn_c \; AND \; cm_c)$	

4.2. Model modification to incorporate a multi-trade partner setup

The multi-trade partner set up is introduced in STAGE-2 by extending the Armington assumption to differentiate import by the country of origin. The modelling approach used by McDonald and Thierfelder (2015) in the multi-country GLOBE model is adapted to the single-country model of this thesis. Accordingly, the export supply to different partners is modelled as a two-level CET functions, while the import demand is modelled with a two-stage CES functions. A visual representation of the nest structure is provided in Figure A4 with an exemplary number of three trade partners.

Figure A4. Representation of the nesting structure with multiple trade partners



Source: Own illustration

At the first level of the nest for the export supply, domestic prices of exports of commodity c by destination w ($PER_{c,w}$) are defined as the product of the world market price ($PWE_{c,w}$) – also defined by commodity c and destination w – the exchange rate, and one minus the export tax rates that are also define by commodity c and destination w. The equation [EX1] is only implemented for commodities that are exported to destination w (cew). World market prices are also declared as variables and can be fixed or made flexible in the closure rules, according to whether one assumes a small country or not.

At the second level of the nest, the price of aggregate export (PE_c) is a simple volume-weighted average of the domestic prices of export to different destinations, after accounting for the trade and transport margins used for these exports (Equation [EX2]).

In quantity terms, the composite export supply (QE_c) is a CET aggregate of commodity export to different destinations ($QER_{c,w}$) and the appropriate first order condition is given in ([EX3]), where $\gamma^e_{c,w}$ is the share parameter, ρ^e_c the elasticity parameter and at^e_c the efficiency parameter. The equation [EX3] is a straightforward manipulation of a more conventional representation, which is used because it reduces the number of equations and improves the model performance.

Name	Equation	Variable
EX1	$PER_{c,w} = PWE_{c,w} * ER_w * (1 - TE_{c,w}) \ \forall\, cew_{c,w}$	$PER_{c,w}$
EX2	$PE_c = \dfrac{\sum_w (PER_{c,w} * QER_{c,w})}{QE_c} - \sum_m (ioqttqe_{m,c} * PTT_m) \quad \forall\, ce_c$	PE_c

EX3	$QER_{c,w} = QE_c * \left[\frac{PER_{c,w}}{\left(\left(\left(PE_c - \sum_m (ioqttqe_{m,c} * PTT_m) \right) * \gamma^e_{c,w} * at^e_c \right)^{\rho^e_c} \right)} \right]^{\frac{1}{\rho^e_c - 1}}$ $\forall\ cew_{c,w}$	$QER_{c,w}$

On the import side, imports are modelled as a two-level CES aggregate. At the first level of the nest, the domestic prices of imports of commodity c from origin w ($PMR_{w,c}$) are defined in Equation [IM1] as the product of the world market price ($PWM_{w,c}$) – also defined by commodity c and origin $w -$ the exchange rate, and one plus the tariffs that are also defined by commodity c and origin w. Equation [IM1] is specified for commodities imported from each origin (set cmw).

At the second level, the price of composite imports (PM_c) is a simple volume-weighted average of the domestic prices of import from individual regions as given in Equation [IM2]. The weights are the quantity of imports from each origin ($QMR_{w,c}$). Equation [IM2] is defined for all commodities that are imported (cm).

The composite import (QM_c) is a CES aggregate of quantity of import of commodity c from origin w ($QMR_{w,c}$) and the appropriate first order condition is given in equation [IM3] where $\delta^m_{w,c}$ is the share parameter, ρ^m_c the elasticity parameter and acm_c the efficiency parameter. IM3 is a straightforward manipulation of a more conventional representation, which is used because it reduces the number of equations and improves the model performance.

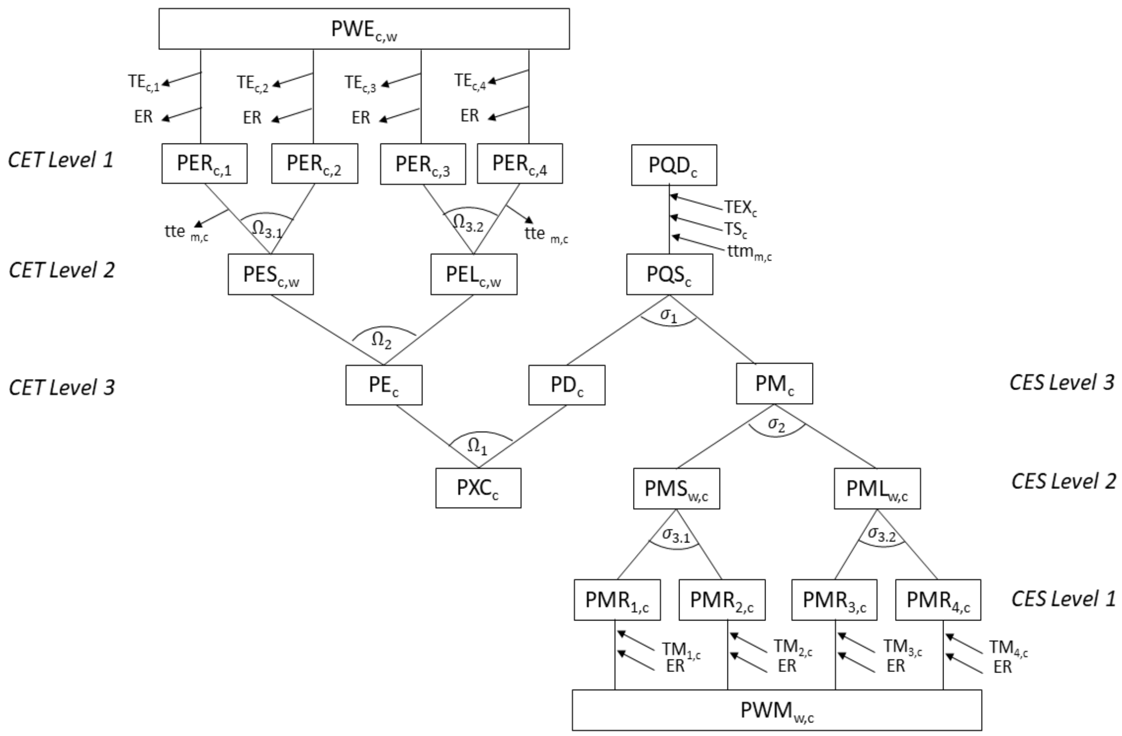
Name	Equation	Variable
IM1	$PMR_{w,c} = PWM_{w,c} * ER_w * (1 + TM_{w,c}) \qquad \forall\ cmw_{w,c}$	$PMR_{w,c}$
IM2	$PM_c * QM_c = \sum_w (PMR_{w,c} * QMR_{w,c}) \qquad \forall\ cm_c$	PM_c
IM3	$QMR_{w,c} = QM_c * \left[\frac{PMR_{w,c} * acm_c^{\rho^m_c}}{(PM_c * \delta^m_{w,c})} \right]^{-\left(\frac{1}{\rho^m_c + 1}\right)} \qquad \forall\ cmw_{w,c}$	$QMR_{w,c}$

Beside the trade equations described above, the introduction of the multi-trade partner set-up also involves the modification of other equations that require parameters and variables associated with the foreign account, since those parameters and variables are no longer unidimensional but bidimensional.

4.3. Small and large share trade specification

The STAGE-2 model does not provide any special treatment for small and large trade shares for commodities by region. A subsequent problem is the large terms of trade effects of trade liberalisation simulations for regions having initially small trade shares. For this purpose, the approach used by McDonald and Thierfelder (2015) for imports in the multi-country model (GLOBE) is modified to fit a single-country model and is extended to exports. The modified model is used in Chapter 9 of this thesis that focuses on Palestinian trade options including trade liberalisation. The modelling approach consisted in extending the previous trade nest from a two-stage CES and CET functions respectively for imports and exports to three-stage functions, as represented in Figure A5.

Figure A5. Nesting structure with multiple trade partners and small/large trade shares specification



Source: Own illustration

For nesting the export side, two new sets are created and defined over commodity and destination: $cewl$ that consists of commodity c for which a large share is sent to destination w; and $cews$ comprising commodity c for which a small share is sent to destination w. The user of the modified model can set the share threshold for what should be considered large and small exogenously.

At the first level of the nest, domestic prices of exports of commodity c, by destination w ($PER_{c,w}$) are defined in equation [EP1] as the product of the world market price ($PWE_{c,w}$) – also defined by commodity c and destination w – the exchange rate, and one minus the export tax rates that are also defined by commodity c and destination w. Equation [EP1] is implemented for commodities that are exported (cew).

At the second level of the nest, the domestic prices of export to individual destinations ($PER_{c,w}$) form two aggregates: PEL_c for regions w receiving large shares of commodity c and PES_c for regions w receiving small shares of commodity c. The composite prices PEL_c and PES_c are defined only with respect to commodity c since they are aggregated over destinations. Hence, they apply respectively to the sets cel encompassing all commodities with large trade shares, regardless of the destination, and ces that consists of all commodities with small trade shares regardless of the destination. PEL_c and PES_c are simple volume-weighted average $PER_{c,w}$, after consideration of the transport and trade margin prices (Equations [EP2.1] and [EP2.2]). At the third level of the nest, the price of aggregate export (PE_c) is a volume-weighted average PEL_c and PES_c (Equation [EP3]).

Name	Equation	Variable
EP1	$PER_{c,w} = PWE_{c,w} * ER * (1 - TE_{c,w})\ \forall\ cew_{c,w}$	$PER_{c,w}$
EP2.1	$PEL_c = \frac{\sum_w (PER_{c,w} * QER_{c,w})}{QEL_c} - \sum_m (ioqttqel_{m,c} * PTT_m) \quad \forall\ cel_c$	PEL_c
EP2.2	$PES_c = \frac{\sum_w (PER_{c,w} * QER_{c,w})}{QES_c} - \sum_m (ioqttqes_{m,c} * PTT_m) \quad \forall\ ces_c$	PES_c
EP3	$PE_c * QE_c = (PEL_c * QEL_c) + (PES_c * QES_c) \quad \forall\ ce_c$	PE_c

In quantity terms, the composite export supply (QE_c) is a CET aggregate of commodity export with large and small shares (QEL_c and QES_c) defined in [EP4], where γ_c^e is the share parameter, ρ_c^e the elasticity parameter and ate_c the efficiency parameter. The associated first order conditions [EP5] determine the optimal allocation in terms of a ratio of the composites prices PEL_c and PES_c. These conditions are controlled by the sets ces and cel, meaning that they hold for commodities that are both exported to large and small share destinations. In case a commodity is only exported to large share destinations, then the total export supply (QE_c) equals only the supply to large share destinations (QEL_c) [EP6].

Both QEL_c and QES_c are defined as CET aggregates of commodity export to different destinations ($QER_{c,w}$). The equation [EP7.1] shows the first order condition for the aggregation of PEL_c where $\gamma_{c,w}^{el}$ is the share parameter, ρ_c^{el} the elasticity parameter and ate_c^l the efficiency parameter. This first order condition is controlled by the set $cewl$, meaning that it only holds for commodity that are exported to large share destinations. The equation [EP7.2] shows the first order condition for the aggregation of PES_c where $\gamma_{c,w}^{es}$ is the share parameter, ρ_c^{es} the elasticity parameter and ate_c^s the efficiency parameter. This first order condition is controlled by the set $cews$ meaning that it only holds for commodities that are exported to small share destinations. The equations [EP7.1] and [EP7.2] are both straightforward manipulations of a more conventional representation. These manipulations reduce the number of equations and improve the model performance.

Name	Equation	Variable
EP4	$QE_c = ate_c * \left(\gamma_c^e * QEL_c^{\rho_c^e} + (1-\gamma_c^e) * QES_c^{\rho_c^e}\right)^{\frac{1}{\rho_c^e}} \quad \forall\, cel_c \text{ and } ces_c$	QES_c
EP5	$QEL_c = QES_c \left[\frac{PEL_c}{PES_c} * \frac{(1-\gamma_c^e)}{\gamma_c^e}\right]^{\frac{1}{(\rho_c^e - 1)}} \quad \forall\, ce_c \text{ and } cd_c$	QEL_c
EP6	$QE_c = QEL_c + QES_c \quad \forall\, (cel_c \text{ AND } cesn_c) \text{ OR } (celn_c \text{ and } ces_c)$	
EP7.1	$QER_{c,w} = QEL_c * \left[\frac{PER_{c,w}}{\left(\left(\left(PEL_c - \sum_m \left(ioqttqel_{m,c} * PTT_m\right)\right) * \gamma_{c,w}^{el} * ate_c^l\right)^{\rho_c^{el}}\right)}\right]^{\frac{1}{\rho_c^{el}-1}}$ $\forall\, cewl_{c,w}$	$QER_{c,w}$
EP7.2	$QER_{c,w} = QES_c * \left[\frac{PER_{c,w}}{\left(\left(\left(PES_c - \sum_m \left(ioqttqes_{m,c} * PTT_m\right)\right) * \gamma_{c,w}^{es} * ate_c^s\right)^{\rho_c^{es}}\right)}\right]^{\frac{1}{\rho_c^{es}-1}}$ $\forall\, cews_{c,w}$	$QER_{c,w}$

For flexibility, it is possible to assume a Leontief technology for the aggregation of QEL_c and QES_c. In that case, the equations [EP4] and [EP5] have to be replaced with equations [EP8] and [EP9] which define export of commodity c to large share destinations (QEL_c) and small share destinations (QES_c) respectively as a fixed proportion of total export of commodity c (QE_c). Similarly, to impose a Leontief function for the aggregation of QER into QEL_c and QES_c, equations [EP7.1] and [EP7.2] should be replaced with [EP10.1] and [EP10.2] where export of commodity c to individual region ($QER_{c.w}$) is a fixed proportion of QEL_c and QES_c respectively.

Name	*Equation*	*Variable*
EP8	$QEL_c = ioqelqe_c * QE_c \quad \forall\, cel_c$	QML_c
EP9	$QEL_c = ioqesqe_c * QE_c \quad \forall\, ces_c$	QMS_c
EP10.1	$QER_{c.w} = ioqelqel_{c,w} * QEL_c \quad \forall\, cewl_{c,w}$	$QER_{c,w}$
EP10.2	$QER_{c,w} = ioqesqes_{c,w} * QES_c \quad \forall\, cews_{c,w}$	$QMR_{w,c}$

For incorporating the large and small trade share specification on the import side, two new sets are also created and defined over origin and commodity: $cmwl$ consists of commodity c for which a large share is imported from region w; and $cmws$ comprises commodity c for which a small share is sourced from region w. The threshold to define large and small shares is set exogenously by the user of the modified model. At the first level of the nest, the domestic prices of imports of commodity c by origin w ($PMR_{w,c}$) are defined as the product of the world market price of imports ($PWM_{w,c}$), the exchange rate, and one plus the tariff rates that are also define by origin w and commodity c. The equation [MP1] is implemented for all commodities that are imported (cmw).

At the second level of the nest, the domestic prices of import from individual origins ($PMR_{c,w}$) are combined to form two aggregates: PML_c for regions w from which large shares of commodity c are sourced, and PMS_c for regions w where small shares of commodity c are sourced. The composite prices PML_c and PMS_c are defined only with respect to commodity and apply respectively to the set cml encompassing all commodities with large import shares, regardless of the origin, and the set cms that consists of all commodities with small import shares. PML_c and PMS_c are simple volume-weighted average of PMR_c (Equations [MP2.1] and [MP2.2]).

At the third level of the nest, the price of aggregate export (PM_c) is a simple volume-weighted average of PML_c and PMS_c (Equation [MP3]).

Name	Equation	Variable
MP1	$PMR_{w,c} = PWM_{w,c} * ER * \left(1 + TM_{w,c}\right) \ \forall\, cmw_{w,c}$	$PMR_{w,c}$
MP2.1	$PML_c = \dfrac{\sum_w \left(PMR_{w,c} * QMR_{w,c}\right)}{QML_c} \quad \forall\, cml_c$	PML_c
MP2.2	$PMS_c = \dfrac{\sum_w \left(PMR_{w,c} * QMR_{w,c}\right)}{QMS_c} \quad \forall\, cms_c$	PMS_c
MP3	$PM_c * QM_c = (PML_c * QML_c) + (PMS_c * QMS_c) \quad \forall\, cm_c$	PE_c

The differentiation of total import (QM_c) of commodity c between import sourced from large share regions (QML_c) and small share regions (QMS_c) is implemented with a CES function defined in MP4, where δ_c^m is the share parameter, ρ_c^m the elasticity parameter and acm_c the efficiency parameter. The associated first order conditions [MP5] determine the optimal allocation in terms of a ratio of the composites prices PML_c and PMS_c. These conditions are controlled by the sets cms and cml, meaning that they hold for commodities that are both imported from large and small share regions. In case a commodity is only imported from large share regions, the total import (QM_c) equals only import from large share regions (QML_c) [MP6].

Both QML_c and QMS_c are defined as CES aggregates of commodity import from different origins ($QMR_{w,c}$). Equations [MP7.1] gives the first order condition for the aggregation of PML_c where $\delta_{w,c}^{ml}$ is the share parameter, ρ_c^{ml} the elasticity parameter and $acml_c^{\rho_c^{ml}}$ the efficiency parameter. This first order condition is controlled by the set $cmwl$, meaning that it only holds for commodity that are imported from large share regions.

The equation [MP7.2] gives the first order condition for the aggregation of PMS_c, where $\delta_{w,c}^{ms}$ is the share parameter, ρ_c^{ms} the elasticity parameter and $acms_c^{\rho_c^{ms}}$ the efficiency parameter. This equation is controlled by the set $cmws$, meaning that it only holds for commodity that are imported from small share regions.

The equations [MP7.1] and [MP7.2] are both straightforward manipulations of a more conventional representation. These manipulations reduce the number of equations and improve the model performance.

Name	Equation	Variable
MP4	$QM_c = acm_c * \left(\delta_c^m * QML_c^{-\rho_c^m} + (1 - \delta_c^m) * QMS_c^{-\rho_c^m}\right)^{-\left(\frac{1}{\rho_c^m}\right)} \quad \forall\ cml_c\ \ and\ cms_c$	QMS_c
MP5	$QML_c = QMS_c * \left[\frac{PMS_c}{PML_c} * \frac{\delta_c^m}{1 - \delta_c^m}\right]^{\frac{1}{\rho_c^m + 1}} \quad \forall\ cml_c\ \ and\ cms_c$	QML_c
MP6	$QM_c = QML_c + QMS_c\ \ \forall\ (cml_c\ and\ cmsn_c)\ OR\ (\ cmln_c\ and\ cms_c)$	
MP7.1	$QMR_{w,c} = QML_c * \left[\frac{PMR_{w,c} * acml_c^{\rho_c^{ml}}}{(\ PMS_c * \delta_{w,c}^{ml}\ )}\right]^{-\left(\frac{1}{\rho_c^{ml}+1}\right)} \quad \forall\ cmwl_{w,c}$	$QMR_{w,c}$
MP7.2	$QMR_{w,c} = QMS_c * \left[\frac{PMR_{w,c} * acms_c^{\rho_c^{ms}}}{(\ PMS_c * \delta_{w,c}^{ms}\ )}\right]^{-\left(\frac{1}{\rho_c^{ms}+1}\right)} \quad \forall\ cmws_{w,c}$	$QMR_{w,c}$

For flexibility, it is possible to assume a Leontief technology for the aggregation of QML_c and QMS_c. In that case, equation [MP4] and [MP5] have to be replaced with equations [MP8] and [MP9]. The equation [MP8] defines import of commodity c from large share regions (QML_c) as a fixed proportion of the total import of commodity c (QM_c). Similarly, the equation [MP9] defines the import of commodity c from small share regions (QMS_c) as a fixed proportion of the total import of commodity c (QM_c). To impose a Leontief function for the aggregation of $QMR_{w,c}$ into QML_c and QMS_c, equations [MP7.1] and [MP7.2] should be replaced with [MP10.1] and [MP10.2] where import of commodity c from individual regions ($QMR_{w,c}$) are fixed proportions of QML_c and QMS_c respectively.

Name	*Equation*	*Variable*
MP8	$QML_c = ioqmlqm_c * QM_c \quad \forall\, cml_c$	QML_c
MP9	$QML_c = ioqmsqm_c * QM_c \quad \forall\, cms_c$	QMS_c
MP10.1	$QMR_{w,c} = ioqmlqml_{w,c} * QML_c \quad \forall\, cmwl_{w,c}$	$QMR_{w,c}$
MP10.2	$QMR_{w,c} = ioqmsqms_{w,c} * QMS_c \quad \forall\, cmws_{w,c}$	$QMR_{w,c}$

4.4. Tariff-rate-quotas

Tariff-rate-quotas are modelled in Chapter 9 to capture the use of this policy instrument on agricultural and food products in the West Bank. As these tariff-rate-quotas shield the domestic sectors against import competition, not modelling them would underestimate the effects of the trade liberalisation simulations that are run.

The mixed complementary problem modelling approach used by (Flaig *et al.*, 2013c) in the context of a single-trade-partner CGE model is modified to fit the case of a multi-trade-partner specification used in this thesis. Accordingly, the quantity imported by region and commodity ($QMR_{w,c}$) consists of in-quota imports ($QMI_{w,c}$) and out-of-quota imports ($QMO_{w,c}$). $QMI_{w,c}$ and $QMO_{w,c}$ are calibrated to the base data.

When the imported quantity is below the quota, the quota premium rate (τ^p) is zero. If the imported quantity surpasses the quota, τ^p is exactly the difference between the out-of-quota tariff rate (τ^o) and the in-quota rate (τ^i). With a binding quota, i.e. when the imported quantity equals the quota, τ^p lies between zero and the difference between the in- and out-of-quota tariff rates. τ^p is determined by Equation [TRQ1], while τ^o and τ^i are calibrated from the data. For the products to which the tariff-rate-quota system is applied, the tariff rate ($TM_{w,c}$) is composed of the in-quota tariff (τ^i) that is levied on total import ($QMR_{w,c}$) and the quota premium (τ^p) that applies only to out-of-quota imports ($QMO_{w,c}$) (see equation [TRQ2]).

As import licenses are distributed to Palestinian importers free of charge, the quota rent accrues to the Palestinian enterprises as shown in equation [TRQ3], where $YENT$ is the enterprise basic income and YE the final income including the quota rent. The government tariff revenue is defined in equation [TRQ4]. The government receives the tariff revenue, while enterprises receive the quota rent. However, both the tariff revenue and the quota rent are ultimately paid by the consumers. Hence, the equation [MP1] of the previous section defining the domestic prices of import ($PMR_{w,c}$) of commodity c from region w needs to be adjusted to incorporate the domestic price of import in addition to the tariff rate and the quota rent (see equation [TRQ5]).

Name	*Equation*	*Variable*
TRQ1	$0 \leq \tau^{p}_{w,c} \leq \tau^{o}_{w,c} - \tau^{i}_{w,c} \qquad \forall\, QMO_{w,c} \geq 0$	$\tau^{p}_{w,c}$
TRQ2	$TM_{w,c} = \dfrac{\left(\tau^{i}_{w,c} * QMR_{w,c}\right) + \left(\tau^{p}_{w,c} * QMO_{w,c}\right)}{QMR_{w,c}} \quad \forall\, QMO_{w,c} \geq 0$	$TM_{w,c}$
TRQ 3	$YE = YENT + \sum_{w,c}\left(\tau^{p}_{w,c} * PWM_{w,c} * QMI_{w,c} * ER\right)$	YE
TRQ4	$MTAX = \sum_{w,c}\left(TM_{w,c} * PWM_{w,c} * QMR_{w,c} * ER\right)$	*MTAX*
TRQ5	$PMR_{w,c} = PWM_{w,c} * ER * \left(1 + TM_{w,c} + \dfrac{\tau^{p}_{w,c} * QMI_{w,c}}{QMR_{w,c}}\right) \forall\, cmw_{w,c}$	$PMR_{w,c}$

Appendix 2. List of accounts in the SAM

No	Commodity (c)	No	Commodity (c) – contd.
1	Olives	43	Electrical machinery
2	Cereals, other crops	44	Communication equipment
3	Fruits, nuts and flowers	45	Medical and precision instruments
4	Vegetables, horticultural specialties	46	Vehicle spare parts
5	Animals	47	Cars and lorries
6	Milk	48	Other transport equipment
7	Forestry products	49	Furniture
8	Fishery products	50	Other manufacturing
9	Stone, sand, clay	51	Electricity, gas
10	Other ores, minerals	52	Water
11	Meat, meat products	53	Construction
12	Fish, fish products	54	Maintenance and repair of motor vehicles
13	Processed fruits, vegetables	55	Retail sale of automotive fuel
14	Olive oil	56	Sale of motor vehicles and parts
15	Oils, fats	57	Wholesale of food, beverages, tobacco
16	Dairy products	58	Wholesale of construction materials
17	Prepared animal feeds	59	Other wholesale
18	Grain mills, starches	60	Retail sale of food, beverages, tobacco
19	Bakery products	61	Retail sale of textiles, clothing
20	Other food	62	Retail sale of household appliances
21	Beverages	63	Repair of personal and household goods
22	Tobacco products	64	Other retail sale
23	Textiles	65	Hotels
24	Wearing apparel, furs	66	Restaurants
25	Leather	67	Freight transport by road
26	Leather products, processed	68	Passenger land transport
27	Wood, wood products	69	Other transport, storage, travel agencies
28	Paper, paper products	70	National post activities
29	Publishing, printing	71	Remaining communication
30	Coke, petroleum products	72	Finance, insurance and auxiliary services
31	Pharmaceuticals	73	Imputed rentals of buildings
32	Soaps, detergents, perfumes	74	Other rentals of buildings
33	Other chemical products	75	Other real estate, and business activities
34	Rubbers, plastics	76	Other business activities
35	Cement, lime and plaster	77	Public administration, defence
36	Articles of concrete, cement	78	Education
37	Stone, stone products	79	Health, social work
38	Other non-metallic mineral products	80	Membership organisations
39	Basic metals	81	Recreational, cultural and sporting
40	Fabricated metals	82	Other services
41	Machinery, equipment	83	Private households with employees
42	Office and computing machinery		

No	Activity (a)
1	Olive
2	Growing of cereals and other crops n.e.c.
3	Farming animals
4	Forestry
5	Quarrying stone, sand and clay
6	Other mining and quarrying
7	Manufacture of olive oil
8	Other vegetable oil and fats
9	Manufacture of basic foods
10	Manufacture of dairy products
11	Manufacture of grain mills and starches
12	Manufacture of other food
13	Manufacture of textile
14	Manufacture of wearing apparels
15	Manufacture of leather products
16	Manufacture of wood products
17	Manufacture of paper articles
18	Manufacture of publishing and printing
19	Manufacture of coke, chemical prod.
20	Manufacture of rubber, plastics
21	Manufacture of stone
22	Manufacture of other non-metal mineral
23	Manufacture of metal products
24	Manufacture of machinery equipment
25	Manufacture of medical and residuals
26	Manufacture of furniture
27	Electricity and gas supply
28	Construction
29	Maintenance and repair of motor vehicles
30	Retail sale of fuel
31	Sale of motor vehicles and parts
32	Wholesale
33	Repair of personal and household goods
34	Retail sale, remaining
35	Hotels and Restaurants
36	Transport, storage
37	National post activities
38	Remaining communication
39	Financial services
40	Other rental of buildings
41	Other real estate and business activities
42	Other business activities
43	Public administration, defence

No	Activity (a) – contd.
44	Education
45	Health and social work
46	Other community, social services
47	Other services
48	Private households with employees

No	Domestic institutions
1	Government
2	Enterprise
3	Non-profit institutions serving households
4	Zakat
5	Kapital account
6	Stock change

No	Foreign institutions (w)
1	Israel
2	USA
3	EU-28 + EFTA
4	Turkey
5	Jordan
6	GAFTA zone
7	Rest of the world

No	Margins (m)
1	Wholesale margins
2	Retail trade margins
3	Transport margins

No	Factors (f)
1	Low-skilled male unqualified employed in Agriculture
2	Low-skilled male weakly qualified employed in Agriculture
3	Low-skilled male highly qualified employed in Agriculture
4	Low-skilled female employed in Agriculture
5	Low-skilled male unqualified employed in Manufacturing
6	Low-skilled male weakly qualified employed in Manufacturing
7	Low-skilled male highly qualified employed in Manufacturing
8	Low-skilled female employed in Manufacturing
9	Low-skilled male unqualified employed in Construction
10	Low-skilled male weakly qualified employed in Construction
11	Low-skilled male highly qualified employed in Construction
12	Low-skilled male unqualified employed in Trade and Hotel
13	Low-skilled male weakly qualified employed in Trade and Hotel
14	Low-skilled male highly qualified employed in Trade and Hotel
15	Low-skilled female employed in Trade and Hotel
16	Low-skilled male unqualified employed in Transport
17	Low-skilled male weakly qualified employed in Transport
18	Low-skilled male highly qualified employed in Transport
19	Low-skilled male unqualified employed in Services
20	Low-skilled male weakly qualified employed in Services
21	Low-skilled male highly qualified employed in Services
22	Low-skilled female employed in Services
23	High-skilled male unqualified employed in Agriculture
24	High-skilled male weakly qualified employed in Agriculture
25	High-skilled male highly qualified employed in Agriculture
26	High-skilled female employed in Agriculture
27	High-skilled male unqualified employed in Manufacturing
28	High-skilled male weakly qualified employed in Manufacturing
29	High-skilled male highly qualified employed in Manufacturing
30	High-skilled female employed in Manufacturing
31	High-skilled male unqualified employed in Construction
32	High-skilled male weakly qualified employed in Construction
33	High-skilled male highly qualified employed in Construction
34	High-skilled female employed in Construction
35	High-skilled male unqualified employed in Trade and Hotel
36	High-skilled male weakly qualified employed in Trade and Hotel
37	High-skilled male highly qualified employed in Trade and Hotel
38	High-skilled female employed in Trade and Hotel
39	High-skilled male unqualified employed in Transport
40	High-skilled male weakly qualified employed in Transport
41	High-skilled male highly qualified employed in Transport
42	High-skilled female employed in Transport
43	High-skilled male unqualified employed in Services

No	Factors (f) – contd.
44	High-skilled male weakly qualified employed in Services
45	High-skilled male highly qualified employed in Services
46	High-skilled female employed in Services
47	Permitted low-skilled labour in the Israeli market
48	Unpermitted low-skilled labour in the Israeli market
49	Permitted high-skilled labour in the Israeli market
50	Unpermitted high-skilled labour in the Israeli market
51	Low-skilled labour unqualified employed abroad
52	Low-skilled labour weakly qualified employed abroad
53	Low-skilled labour highly qualified employed abroad
54	High-skilled labour unqualified employed
55	High-skilled labour weakly qualified employed
56	High-skilled labour highly qualified employed
57	Foreign workers
58	Capital
59	Land

No	Households (h)
1	Quintile 1, low skilled members working only for local employers, no eligible worker
2	Quintile 1, low skilled members working only for local employers, 1+ weakly eligible worker
3	Quintile 1, low skilled members working only for local employers, 1+ highly eligible worker
4	Quintile 1, low skilled members working only for local employers, 1 weakly and 1 highly eligible
5	Quintile 1, low skilled members with at least one working in Israel, no eligible worker
6	Quintile 1, low skilled members with at least one working in Israel, 1+ weakly eligible worker
7	Quintile 1, low skilled members with at least one working in Israel, 1+ highly eligible worker
8	Quintile 1, low skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
9	Quintile 1, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
10	Quintile 1, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
11	Quintile 1, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
12	Quintile 1, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
13	Quintile 1, high skilled members working only for local employers, no eligible worker
14	Quintile 1, high skilled members working only for local employers, 1+ weakly eligible worker
15	Quintile 1, high skilled members working only for local employers, 1+ highly eligible worker
16	Quintile 1, high skilled members with at least one working in Israel, 1+ weakly eligible worker
17	Quintile 1, high skilled members with at least one working in Israel, 1+ highly eligible worker
18	Quintile 1, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
19	Quintile 1, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker

No	Households (h) – contd.
20	Quintile 2, low skilled members working only for local employers, no eligible worker
21	Quintile 2, low skilled members working only for local employers, 1+ weakly eligible worker
22	Quintile 2, low skilled members working only for local employers, 1+ highly eligible worker
23	Quintile 2, low skilled members working only for local employers, 1 weakly and 1 highly eligible
24	Quintile 2, low skilled members with at least one working in Israel, no eligible worker
25	Quintile 2, low skilled members with at least one working in Israel, 1+ weakly eligible worker
26	Quintile 2, low skilled members with at least one working in Israel, 1+ highly eligible worker
27	Quintile 2, low skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
28	Quintile 2, low skilled members with at least one working in foreign diplomatic missions residing in the West Bank, no eligible worker
29	Quintile 2, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
30	Quintile 2, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
31	Quintile 2, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
32	Quintile 2, high skilled members working only for local employers, no eligible worker
33	Quintile 2, high skilled members working only for local employers, 1+ weakly eligible worker
34	Quintile 2, high skilled members working only for local employers, 1+ highly eligible worker
35	Quintile 2, high skilled members with at least one working in Israel, 1+ weakly eligible worker
36	Quintile 2, high skilled members with at least one working in Israel, 1+ highly eligible worker
37	Quintile 2, high skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
38	Quintile 2, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
39	Quintile 2, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
40	Quintile 2, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
41	Quintile 2, high skilled members with at least one working in for f foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
42	Quintile 3, low skilled members working only for local employers, no eligible worker
43	Quintile 3, low skilled members working only for local employers, 1+ weakly eligible worker
44	Quintile 3, low skilled members working only for local employers, 1+ highly eligible worker
45	Quintile 3, low skilled members working only for local employers, 1 weakly and 1 highly eligible workers
46	Quintile 3, low skilled members with at least one working in Israel, no eligible worker
47	Quintile 3, low skilled members with at least one working in Israel, 1+ weakly eligible worker
48	Quintile 3, low skilled members with at least one working in Israel, 1+ highly eligible worker
49	Quintile 3, low skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
50	Quintile 3, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker

No	Households (h) – contd.
51	Quintile 3, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
52	Quintile 3, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
53	Quintile 3, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
54	Quintile 3, high skilled members working only for local employers, no eligible worker
55	Quintile 3, high skilled members working only for local employers, 1+ weakly eligible worker
56	Quintile 3, high skilled members working only for local employers, 1+ highly eligible worker
57	Quintile 3, high skilled members working only for local employers, 1 weakly and 1 highly eligible workers
58	Quintile 3, high skilled members with at least one working in Israel, no eligible worker
59	Quintile 3, high skilled members with at least one working in Israel, 1+ weakly eligible worker
60	Quintile 3, high skilled members with at least one working in Israel, 1+ highly eligible worker
61	Quintile 3, high skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
62	Quintile 3, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
63	Quintile 3, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
64	Quintile 3, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
65	Quintile 4, low skilled members working only for local employers, no eligible worker
66	Quintile 4, low skilled members working only for local employers, 1+ weakly eligible worker
67	Quintile 4, low skilled members working only for local employers, 1+ highly eligible worker
68	Quintile 4, low skilled members working only for local employers, 1 weakly and 1 highly eligible workers
69	Quintile 4, low skilled members with at least one working in Israel, no eligible worker
70	Quintile 4, low skilled members with at least one working in Israel, 1+ weakly eligible worker
71	Quintile 4, low skilled members with at least one working in Israel, 1+ highly eligible worker
72	Quintile 4, low skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
73	Quintile 4, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
74	Quintile 4, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
75	Quintile 4, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
76	Quintile 4, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
77	Quintile 4, high skilled members working only for local employers, no eligible worker
78	Quintile 4, high skilled members working only for local employers, 1+ weakly eligible worker
79	Quintile 4, high skilled members working only for local employers, 1+ highly eligible worker
80	Quintile 4, high skilled members working only for local employers, 1 weakly and 1 highly eligible workers

No	Households (h) – contd.
81	Quintile 4, high skilled members with at least one working in Israel, no eligible worker
82	Quintile 4, high skilled members with at least one working in Israel, 1+ weakly eligible worker
83	Quintile 4, high skilled members with at least one working in Israel, 1+ highly eligible worker
84	Quintile 4, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
85	Quintile 4, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
86	Quintile 4, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
87	Quintile 5, low skilled members working only for local employers, no eligible worker
88	Quintile 5, low skilled members working only for local employers, 1+ weakly eligible worker
89	Quintile 5, low skilled members working only for local employers, 1+ highly eligible worker
90	Quintile 5, low skilled members working only for local employers, 1 weakly and 1 highly eligible workers
91	Quintile 5, low skilled members with at least one working in Israel, no eligible worker
92	Quintile 5, low skilled members with at least one working in Israel, 1+ weakly eligible worker
93	Quintile 5, low skilled members with at least one working in Israel, 1+ highly eligible worker
94	Quintile 5, low skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
95	Quintile 5, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
96	Quintile 5, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
97	Quintile 5, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
98	Quintile 5, low skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker
99	Quintile 5, high skilled members working only for local employers, no eligible worker
100	Quintile 5, high skilled members working only for local employers, 1+ weakly eligible worker
101	Quintile 5, high skilled members working only for local employers, 1+ highly eligible worker
102	Quintile 5, high skilled members working only for local employers, 1 weakly and 1 highly eligible workers
103	Quintile 5, high skilled members with at least one working in Israel, no eligible worker
104	Quintile 5, high skilled members with at least one working in Israel, 1+ weakly eligible worker
105	Quintile 5, high skilled members with at least one working in Israel, 1+ highly eligible worker
106	Quintile 5, high skilled members with at least one working in Israel, 1 weakly and 1 highly eligible worker
107	Quintile 5, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, no eligible worker
108	Quintile 5, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ weakly eligible worker
109	Quintile 5, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1+ highly eligible worker
110	Quintile 5, high skilled members with at least one working in for foreign diplomatic missions residing in the West Bank, 1 weakly and 1 highly eligible worker

No	Taxes (g)
1	Production tax
2	Factor income tax
3	Income tax
4	Property tax
5	Excise tax
6	Value Added Tax collected domestically
7	Value Added Tax collected on imports
8	Tariff on imports from Israel
9	Tariff on imports from the USA
10	Tariff on imports from the EU-28 and EFTA
11	Tariff on imports from Turkey
12	Tariff on imports from Jordan
13	Tariff on imports from GAFTA zone
14	Tariff on imports from the rest of the world
15	Factor tax use on low-skilled male unqualified employed in Agriculture
16	Factor tax use on low-skilled male weakly qualified employed in Agriculture
17	Factor tax use on low-skilled male highly qualified employed in Agriculture
18	Factor tax use on low-skilled female employed in Agriculture
19	Factor tax use on low-skilled male unqualified employed in Manufacturing
20	Factor tax use on low-skilled male weakly qualified employed in Manufacturing
21	Factor tax use on low-skilled male highly qualified employed in Manufacturing
22	Factor tax use on low-skilled female employed in Manufacturing
23	Factor tax use on low-skilled male unqualified employed in Construction
24	Factor tax use on low-skilled male weakly qualified employed in Construction
25	Factor tax use on low-skilled male highly qualified employed in Construction
26	Factor tax use on low-skilled male unqualified employed in Trade and Hotel
27	Factor tax use on low-skilled male weakly qualified employed in Trade and Hotel
28	Factor tax use on low-skilled male highly qualified employed in Trade and Hotel
29	Factor tax use on low-skilled female employed in Trade and Hotel
30	Factor tax use on low-skilled male unqualified employed in Transport
31	Factor tax use on low-skilled male weakly qualified employed in Transport
32	Factor tax use on low-skilled male highly qualified employed in Transport
33	Factor tax use on low-skilled male unqualified employed in Services
34	Factor tax use on low-skilled male weakly qualified employed in Services
35	Factor tax use on low-skilled male highly qualified employed in Services
36	Factor tax use on low-skilled female employed in Services
37	Factor tax use on high-skilled male unqualified employed in Agriculture
38	Factor tax use on high-skilled male weakly qualified employed in Agriculture
39	Factor tax use on high-skilled male highly qualified employed in Agriculture
40	Factor tax use on high-skilled male unqualified employed in Manufacturing
41	Factor tax use on high-skilled male weakly qualified employed in Manufacturing
42	Factor tax use on high-skilled male highly qualified employed in Manufacturing
43	Factor tax use on high-skilled female employed in Manufacturing

No	Taxes (g) – contd.
44	Factor tax use on high-skilled male unqualified employed in Construction
45	Factor tax use on high-skilled male weakly qualified employed in Construction
46	Factor tax use on high-skilled male highly qualified employed in Construction
47	Factor tax use on high-skilled female employed in Construction
48	Factor tax use on high-skilled male unqualified employed in Trade and Hotel
49	Factor tax use on high-skilled male weakly qualified employed in Trade and Hotel
50	Factor tax use on high-skilled male highly qualified employed in Trade and Hotel
51	Factor tax use on high-skilled female employed in Trade and Hotel
52	Factor tax use on high-skilled male unqualified employed in Transport
53	Factor tax use on high-skilled male weakly qualified employed in Transport
54	Factor tax use on high-skilled male highly qualified employed in Transport
55	Factor tax use on high-skilled female employed in Transport
56	Factor tax use on high-skilled male unqualified employed in Services
57	Factor tax use on high-skilled male weakly qualified employed in Services
58	Factor tax use on high-skilled male highly qualified employed in Services
59	Factor tax use on high-skilled female employed in Services

Appendix 3. Description of West Bank SAM construction

This appendix describes in detail, cell by cell, the process of assembling the prior macro-SAM, and the breakdown of the macro-SAM accounts into the detailed SAM.

3.1. Assembling the prior macro-SAM

This subsection presents the data sources and procedures followed to derive the values for each entry of the macro-SAM. The rows of the macro-SAM are labelled with numbers – from 1 to 15 – while columns are labelled with letters – from A to O – as in Table 3.1. The cell carrying the value of total intermediate inputs, for instance, is labelled (1, C). This section is organised by cell entry. It starts with the top row of the macro-SAM – i.e. Row 1 – and it covers all cells in this row from cell (1,B) to cell (1,N). Then, it moves to the second row and so on until the last cell in the bottom row, i.e. Row 15.

(1, B) Margins

This entry includes trade and transport margins, for which estimates in 2004 are available in the West Bank Supply and Use Table (SUT) (PCBS, 2014a). These 2004 estimates are then updated to the year 2011 – which is the reference year of the SAM- by using the 2011 National Accounts (NA) for the West Bank (PCBS, 2014b) and by assuming that the margins are a constant share of production cost in the trade and transport sectors.

(1, C) Intermediate inputs

This entry reports the demand for intermediate inputs by productive activities. Its value is computed by summing up the sectoral intermediate consumption which is provided in the NA for the year 2011 (PCBS, 2014b).

(1, G) Household Consumption

The value of household consumption in 2011 is derived from the NA (PCBS, 2014b).

(1, H) NPISH consumption

The value of NPISH consumption is taken from the 2011 NA (PCBS, 2014b).

(1, J) Government consumption

The value of government consumption stems from the 2011 NA (PCBS, 2014b).

(1, M) Investment demand

The value of gross fixed capital formation and change in inventories are from the 2011 NA (PCBS, 2014b).

(1, N) Exports

The value of total export from the West Bank is taken from the 2011 NA (PCBS, 2014b).

(2, A) Margins

This cell reports the value of trade and transport margins paid by all commodities. This value equals the one displayed in cell (1, B).

(3, A) Market output

This is the sum of output of individual production sectors according to the 2011 NA (PCBS, 2014b).

(4, C) Labour compensation

The labour compensation is the part of labour income in total value added. It includes in addition to the compensation of employees, the compensation for self-employed labour. The compensation of employees is computed by multiplying the average wage in the West Bank in 2011 by the number of wage-workers (see Table A1). The data used are based on the labour force survey report of 2011 (PCBS, 2012a). The labour compensation of the self-employed is computed by multiplying the number of self-employed workers by their average earning (see Table A1). This average earning is calculated by adding to the average wage of wage-workers the earning premium associated with self-employment in the Middle East.

(4, N) Compensation of employees from abroad

The total compensation of employees from abroad stems from the Balance of payments (BoP) of 2011 (PCBS, 2016b).

(5, C) Capital Compensation

This is the part of value added accruing to the factor capital. It is computed by subtracting labour compensation (4, C) and land compensation (6, C) from the total value added (see Table A1). The total value added itself is computed by summing up the sectoral value added from the 2011 NA (PCBS, 2014b).

(5, N) Capital income from abroad

The value of investment income from abroad to the whole Palestine – i.e. the aggregate of West Bank and Gaza – stem from the 2011 BoP (PCBS, 2016b). The share that accrues to the West Bank is derived by applying to the total value the share of the West Bank in the total number of establishments in Palestine. Data on establishments is provided by the establishment census (PCBS, 2012b).

(6, C) Land Compensation

The value of land compensation is derived from the Palestinian Expenditure and Consumption Survey (PECS) of 2011 (PCBS, 2014c) and is scaled up to the entire West Bank population.

(7, D) Household income from labour

Household income from labour is obtained by subtracting from the total labour income factor taxes and the labour compensation paid to the rest of the world.

(7, E) Household income from unincorporated capital

Household income from unincorporated capital is the part of the net capital income directly received by households. The net capital income is computed by adding to capital compensation (5, C) the investment income received from abroad (5, N) and subtracting the investment income paid to abroad (14, E) as well as depreciation (13, E). The share of net capital income that accrues to households is computed based on the share of unincorporated businesses in the West Bank economy. According to Fjeldstad and al-Zagha (2004), this share is about 76% in the West Bank.

(7, F) Household income from land

Household income derived from land ownership is computed from the 2011 PECS (PCBS, 2014c) and is scaled up to the entire West Bank population.

(7, G) Inter-household transfers

These are transfers made by some households to other households, including the religious transfers to poor households (*Zakat*). The aggregate value of these transfers is derived from the 2011 PECS (PCBS, 2014c) and is scaled up to the entire West Bank population.

(7, H) NPISH transfers to households

Total transfers made by non-profit institutions to households is derived from the 2011 PECS (PCBS, 2014c) and is scaled up to the entire West Bank population.

(7, I) Household income from dividends

Income to households from enterprises is computed as a share of the enterprise income before savings. The enterprise income is computed by adding to the return of capital to enterprise (9, E) transfers received from the government (9, J), and subtracting the dividends paid to the government (10, I) as well as corporate taxes (11, I). The share of enterprise income distributed in dividends to households is computed based on the example of the Paltel Group (Larudee, 2012). The Paltel Group is the major telecommunication company in Palestine. Over the period from 2009 to 2010, the company shared 65% of its profit as dividends. Accordingly, that share is also applied to the net enterprise income in the macro-SAM to come to the value of enterprise payments to households as dividends.

(7, J) Government transfers to households

This entry includes all kinds of transfers made by the government to households, namely pensions, gratuities, allowances, etc. The total value of government transfers in the whole Palestine is taken from the Ministry of Finance's fiscal development and macro performance report (MoF, 2012a). This value is adjusted for the West Bank, using the share of the West Bank in the total number of households in Palestine. The number of households stems from the demographics report (PCBS, 2012g).

(7, N) Transfers to households from abroad

The value of transfers (remittances) to the whole Palestine stems from the 2011 BoP (PCBS, 2016b). The share that accrues to the West Bank is derived by applying to the total value the share of the West Bank in the total number of households in Palestine (PCBS, 2012g).

(8, N) Transfers to NPISH from abroad

Non-profit institutions serving households are funded by international organisations and foreign donors. The value for this entry is computed by summing up NPISH consumption (1, H) and NPISH transfers to households (7, H).

(9, E) Enterprise income from capital

Capital return to corporate enterprises is computed using the share of corporate businesses in total businesses in the West Bank based on Fjeldstad and al-Zagha (2004). Accordingly, corporate share of capital income is about 24%.

(9, J) Transfers to enterprises by government

This is the value of subsidies transferred by the government to private enterprises. It is taken from the annual financial report of the Ministry of Finance (MoF, 2012b).

(10, I) Investment profit accruing to government

This entry shows the total value of dividends received by the government from state-owned enterprises. This value is taken from the Ministry of Finance's fiscal development and macro performance report (MoF, 2012a)

(10, K) Direct tax revenue

Direct tax revenue received by the government includes the factor income tax (11, D), income tax on households (11, G) and corporate tax on enterprises (11, I). Data for these cells are obtained from the annual financial report of the Ministry of Finance (MoF, 2012b).

(10, L) Indirect tax revenue

This includes the commodity and activity taxes. Commodity taxes (12, A) are composed of excise taxes, VAT and import taxes, while activity taxes (12, C) are composed of production taxes and factor use taxes.

(10, N) Foreign grants

Foreign grants to the government in the context of the West Bank usually take the form of budget support. The value of transfers to the government sector from abroad for the whole Palestine stems from the 2011 BoP (PCBS, 2016b). The share that accrues to the West Bank is derived by applying to the total value the share of the West Bank in the total Palestinian population (PCBS, 2012g).

(11, D) Factor income tax

This includes the payroll tax levied on West Bank residents working in Israel. The tax is levied by the Israeli administration and transferred to the PNA via the tax clearance mechanism. The value of this tax stems from the annual financial report of the Ministry of Finance (MoF, 2012b). Given that no Gazan worker was admitted in Israel in 2011, the value of this tax for the whole Palestine is attributed to the West Bank.

(11, G) Income and property tax

The value of income tax levied on Palestinian households is derived from the annual financial report of the Ministry of Finance (MoF, 2012b). Adjustments are made in order to derive their values for the West Bank by weighting the total value by the share of the West Bank in the total number of Palestinian households (PCBS, 2012g).The value of property tax is computed from the 2011 PECS (PCBS, 2014c) and is scaled up to the entire West Bank population.

(11, I) Corporate tax

The value of corporate tax collected in the whole Palestine is derived from the annual financial report of the Ministry of Finance (MoF, 2012b).Its value for the West Bank is calculated by weighting the total value with the share of the West Bank in the total number of establishments in Palestine (PCBS, 2012b).

(12, A) Commodity taxes

They include several tax instruments, namely the excise, value added and import taxes. Their values for the whole Palestine stem from the annual financial report of the Ministry of Finance (MoF, 2012b). Various adjustments were made to derive the shares that accrue to the West Bank. For the value added tax (VAT), the share of the West Bank in the total Palestinian value added is used as a weight factor. For the import taxes, the share of the

West Bank in the total Palestinian import is used as a weight factor, while for the excise tax, the share of the West Bank in final consumption is used. Data on value added, import and final consumption are taken from the NA (PCBS, 2014b).

(12, C) Production and factor use taxes

The total value of tax on production activities is computed by taking the tax rate from the 2004 SUT (PCBS, 2014a) and applying it to the tax base (total activity output) of 2011 taken from the 2011 NA (PCBS, 2014b). The total value of factor use tax for the whole Palestine stems from the annual financial report of the Ministry of Finance (MoF, 2012b). Its value for the West Bank is derived by applying to the total value the share of West Bank workers in the total number of Palestinian workers. The labour force data stem from the 2011 labour force survey report (PCBS, 2012a).

(13, E) Depreciation

Depreciation in the West Bank economy in 2011 as a share in value added is derived from the economic survey report (PCBS, 2012c). This share is applied to the total value added taken from the 2011 NA (PCBS, 2014b) to come to the final value for this entry.

(13, G) Household savings

Gross domestic savings in 2011 are taken from the NA (PCBS, 2014b) and the share of private savings in total savings is derived from the IMF report on macroeconomic development and outlook (IMF, 2014). Private savings comprise household savings and enterprise savings. Thus, total private savings are computed and household savings are derived by subtracting the enterprise savings (12, H) from the total private savings.

(13, I) Enterprise savings

Enterprise savings are computed based on the example of Paltel Group over 2009-2010 (Larudee, 2012) where the company kept 35% of its profit as savings. That share is applied to the enterprise income to arrive at the enterprise savings in the macro-SAM.

(13, J) Government savings

Gross domestic savings in 2011 stem from the NA (PCBS, 2014b) and the share of public savings in total savings is derived from the IMF report on macroeconomic development and outlook (IMF, 2014). This share is applied to the gross domestic savings to come to the government savings in 2011.

(13, N) Current account balance

This value is computed as residual in the rest of the world account.

(14, A) Imports from the rest of the world

The total import value of the West Bank in 2011 is obtained from the NA (PCBS, 2014b).

(14, D) Labour compensation paid to abroad

The total value of labour compensation paid abroad is computed by subtracting the net compensation of employees from abroad, taken from the 2011 NA (PCBS, 2014b), from the gross compensation of employees received from abroad (4, N).

(14, E) Capital payment to abroad

Capital payment to the rest of the world is computed by subtracting from the gross capital income received from abroad (5, N) the net capital income from abroad that is derived from the 2011 NA (PCBS, 2014b).

(14, G) Household transfers to abroad

The total value of household transfers to non-residents is derived by subtracting from the value of gross transfers received from abroad by households (6, N), NPISH (7, N) and government (9, N) the value of net current transfer from abroad that is derived from the 2011 NA (PCBS, 2014b).

Table A1. Decomposition of value added

a	**b**	**c**	**d**	**e**	**f**
Number of employed in WB	Number of wage workers	Number of self-employed a-b	Average annual wage per wage worker (in US$)	Total compensation of employees (in Mil. US$) b*d	Earning premium for self-employment in the MENA
534,192	342,468	191,724	6,374.215	2,182.965	37.9%
g	**h**	**h**	**i**	**j**	
Average annual earning per self-employed (in US$) d*(1+f)	Total labour compensation of self-employed (in Mil. US$) c*g	Total labour compensation (in Mil. US$) e+h	Total Value added (in Mil. US$)	Gross operating surplus (in Mil. US$) i-h	
8,790.042	1,685.262	3,868.226	6,573.600	2705.374	

Sources: a, b, c, d, i: labour force survey report (PCBS, 2012a); f: Gindling et al., (2016); j: national accounts (PCBS, 2014b).

3.2. Processing the raw data to assemble the detailed SAM

This section describes the steps followed to disaggregate each entry of the macro-SAM to arrive at the fully articluated SAM. Each entry of the macro-SAM is referred to by two indices, a number for its row and a letter for its column.

(1, B) Margins

In the detailed SAM, trade margins appear as payments from the margin accounts "wholesale" and "retail trade" to the commodity accounts "wholesale" and "retail trade" respectively. Transport margins appear as payments from the account "transport margin" to the commodity account "transportation by road". The initial values are derived from the 2004 SUT (PCBS, 2014a).

(1, C) Intermediate inputs

The intermediate input matrix is derived by summing up the input demand by activity and commodity for all economic agents in the economy except the NPISH. The input demand of NPISH is sorted by commodity and aggregated over activities and assigned to the activity account "anpish". The initial values stem from the 2004 SUT (PCBS, 2014a). Next, these initial values are adjusted to match the 2011 NA values (PCBS, 2014b). The NA provides for 20 sectors of economic activity. In a first instance, the NA sectors are mapped to the 49 SAM activity accounts. Subsequently, the SAM activity accounts with one-to-one mapping to the NA activity sectors, the shares across commodity accounts are kept constant and only the total is updated to the total input demand of that sector in the NA. In case of a mapping between one NA sector and several SAM activity accounts, the shares across activities and commodities are kept constant and the total is updated to the total input demand in the NA.

(1, G) Household Consumption

Initial values for the household consumption matrix are derived from the 2011 PECS (PCBS, 2014c). In the PECS, commodities are grouped based on the classification of individual consumption according to purpose. First, the commodity groups in the PECS are mapped to the SAM commodity accounts. For each household group, total consumption by commodity group is calculated. However, the initial values derived from the raw data were inconsistent. In fact, the aggregated food expenditure made up only 12.4% of all household consumption expenditures, while the living standards report (PCBS, 2012h) shows for the year 2011 that food expenditure makes up 35% of all household consumption expenditure in the West Bank. Subsequently, the initial values derived from the raw data are adjusted using the living standards report.

(1, H) NPISH consumption

NPISH institutions consume services such as education, health and social work. The initial values of NPISH consumption are derived from the SUT of 2004 (PCBS, 2014a).

(1, J) Government consumption

The initial values for government consumption stem from the SUT of 2004 (PCBS, 2014a).

(1, M) Investment demand

Initial values for the Gross Fixed Capital Formation (GFCF) and change in inventories are taken from the 2004 SUT (PCBS, 2014a).

(1, N) Exports

The data on export of goods by destination are derived from the UN Comtrade database (UN Contrade, 2016). Goods in this database are listed according to the Harmonised System (HS) classification. Therefore, a concordance table between the HS classification and the 83 SAM commodity accounts is first established. Next, Palestinian export of goods to the seven destinations considered in the SAM is derived. Given that no export from Gaza was allowed to be sold in Israel in 2011 – because of the blockade (GISHA, 2015) – the total value of Palestinian export to Israel is allocated to the West Bank.

The relative shares of the other destinations in the remaining of the Palestinian export of goods are applied to the West Bank total export of goods – derived from the NA (PCBS, 2014b) – after excluding the imputed export value to Israel so as to arrive at the export values to the other six destinations.

The total value of West Bank export of services stems from the NA (PCBS, 2014b). The disaggregated Palestinian export of services according to the extended balance of payments services classification (EBOPS) is derived from UN Comtrade database (UN Contrade, 2016). First, a mapping between the EBOPS and the SAM commodity classification was established. Second, the split of the total value of export of services across the seven trade partners is conducted based on the inbound visitors survey (PCBS, 2009), hotel activity survey of 2011 (PCBS, 2012d) complemented with PCBS experts' assumptions.

(2, A) Margins

Income to margin accounts comes mostly from agricultural and manufacturing commodity accounts. The initial values are derived from the SUT (PCBS, 2014a).

(3, A) Market output

The "Make matrix" is derived by summing up the market output by activity and commodity for all economic agents except the NPISH. The market output of NPISH is sorted by commodity. Then, it is aggregated over activities and assigned to the activity account "anpish". The initial values are derived from the SUT of 2004 (PCBS, 2014a). Next, these values are updated to match the 2011 NA figures (PCBS, 2014b). The NA provides data for 20 activity sectors. In the first instance, the NA sectors are mapped to the 49 SAM activity accounts. Subsequently, for the SAM activity accounts with one-to-one mapping to NA activity sectors, the shares across commodity accounts are kept constant and only the total is updated to the total market output of each sector based on the 2011 NA. In case of a mapping between one NA sector and several SAM activity accounts, the shares across activities and commodities are kept constant and the total is updated to the total market output in the NA.

(4, C) Labour compensation

The 2011 PECS (PCBS, 2014c) provides detailed information on economically active household members. The characteristics of these active household members are used to classify them along the criteria set for labour categories. The survey provides for six production sectors: agriculture, commerce and restaurants, construction, manufacturing and mining, transportation and communication, and services. First, total income for each labour class is calculated by sector[24]. Second, the six sectors of the survey are mapped to the 49 SAM activity accounts. In case one PECS production sector is mapped to several SAM activity accounts, the value of the labour compensation earned by one labour class from that PECS sector is split equally across all SAM activity accounts. The resulting matrix of initial values is adjusted to discriminate the labour compensation across sectors. The adjustment process uses the distribution of value added across sectors from the SUT (PCBS, 2014a). The obtained values are scaled up to match the totals of the 2011 NA (PCBS, 2014b). As the NA only has 20 sectors, while the SAM has 49, a correspondence table between the two is established and for each sector, the total from the NA is used.

To compute the part of labour compensation paid by activity "anpish", workers employed by non-profit organisations and the United Nations Relief and Work Agency for Palestine refugees in the Near East (UNRWA) are selected from the PECS and their total income is calculated for each labour class. The obtained values are adjusted to match the share of NPISH in total value added in 2011. That share is calculated from the SUT (PCBS, 2014a), while the value added figure is taken from the 2011 NA (PCBS, 2014b).

With regard to labour income accruing to foreign workers, as no information on the sectors employing foreign labour is available, the total value of labour compensation paid to abroad

[24] Wage data for active household members are missing in the 2011 PECS (PCBS, 2014c). Therefore, the average wage per labour class is calculated from the 2011 LFS (PCBS, 2014d) and assigned to workers belonging to the same labour classes in the PECS. Compensation of labour for the own-account workers is directly imputed in the PECS for the respective workers by adding to the average wage received by their counterparts with similar demographic characteristics who are wage workers the earning premium estimated by (Gindling et al., 2016b).

from the macro-SAM is split across all sectors based on their respective shares in the total value added taken from the SUT (PCBS, 2014a).

(4, M) Compensation of employees from abroad

The value of labour income earned by Palestinians working in Israel stems from the 2011 BoP (PCBS, 2016b). Because Gazan workers were banned from working in Israel in 2011, the total value of compensation of employees from Israel is attributed to the West Bank. The matrix of staring values for the factor income from Israel for each labour group stems from the 2011 PECS (PCBS, 2014c). Household members employed in Israel are classified according to the criteria defined for the corresponding labour groups. The total income by labour group for workers employed in Israel is calculated and used as starting value.

The value of compensation of employees from the other regions is computed by subtracting from total compensation of employees from abroad accruing to the West Bank the value of compensation from Israel. Given that this value corresponds to the payroll of Palestinians working for foreign diplomatic missions in the West Bank, the obtained value is split across the six foreign regions based on their respective shares in the total number of diplomatic missions present in the West Bank[25]. The matrix of starting values for the compensation of employee from abroad across the various labour groups is derived from the 2011 PECS (PCBS, 2014c). Household working members are classified according to the criteria defined for the corresponding labour groups. The total income received by household members employed abroad (other than in Israel) is used.

(5, C) Capital compensation

The initial value for capital compensation paid by each activity is the sectoral gross operating surplus derived from the SUT (PCBS, 2014a).

(5, N) Capital income from abroad

This is the investment income received from abroad. The total value in the macro-SAM is split across the seven foreign regions according to their respective shares in the total foreign direct investment received in Palestine (PCBS, 2016d).

(6, C) Land compensation

Land is considered a production factor only for agricultural activities. The total land compensation is distributed over the four agricultural activities based on their respective shares in total land use. Data on land use are derived from PCBS statistics (PCBS, 2016c).

[25] https://en.wikipedia.org/wiki/List_of_diplomatic_missions_in_Palestine

(7, D) Household income from labour

This submatrix stems from the 2011 PECS (PCBS, 2014c) which provides information on West Bank workers and their households. The initial values for this submatrix are calculated as the total income earned by the household working members classified by labour classes and mapped to their respective household groups.

(7, E) Household income from unincorporated capital

This submatrix is also derived from the 2011 PECS (PCBS, 2014c), which provides detailed information on household income sources. The returns from capital to households not transiting through enterprises is the unincorporated capital income. This includes a share of the mixed income as well as rent from buildings. The 2011 PECS provides for household mixed income and rent from buildings. As only a fraction of the mixed income accrues to capital and acknowledging that this fraction is higher for the rich households than it is for the poor households, it is assumed a range from 0.2 to 0.6, with 0.2 being the share of capital in mixed income for the poorest quintile and 0.6 the one for the richest quintile.

(7, F) Household income from land

The matrix of starting values for household income from land is derived from the 2011 PECS (PCBS, 2014c). Income derived by households from land is explicitly provided in the raw data.

(7, G) Inter-household transfers

The transfers received by each household group from other households in the West Bank is calculated from the 2011 PECS (PCBS, 2014c). Using the consumption per adult-equivalent as a wealth indicator, the household groups are ranked from rich to poor. Subsequently, a household group with a lower rank (i.e. a poorer household) receives equal transfers from all household groups with higher ranks. Thus, the wealthiest household group makes transfers to all the others and does not receive any transfer. On the expenditure side, the size of the household group is used as a weight factor to adjust the initial values and make sure that a household group with a smaller size carries less of the burden of the transfers than a larger household group, *certeris paribus*. After this first round of adjustments, a second round of adjustments is conducted to recover the values of total inter-household transfers received by the different household groups, as this is the primal information.

With regard to *Zakat* transfers, the 2011 PECS (PCBS, 2014c) provides information on *Zakat* payment made by households. Total *Zakat* payments by household group is first calculated. The *Zakat* revenue is assumed to accrue only to the lowest income quintile households, since it is a religious transfer from rich to poor households. Again, households are ranked according to consumption per adult-equivalent, and households in the upper four quintiles make identical payments to households in the lowest quintile.

(7, H) NPISH transfers to households

The 2011 PECS (PCBS, 2014c) includes household income from transfers made by non-governmental institutions. This information serves as proxy for the household income from NPISH transfers. Households are sorted by group and the transfers they receive from the non-governmental institutions are calculated and used as initial values for this submatrix.

(7, I) Household income from dividends

The initial values for this submatrix are derived from the 2011 PECS (PCBS, 2014c) which includes household income from stocks, bonds and shares. The total income from these sources is calculated for each household group and is used as a starting value.

(7, J) Government transfers to households

The 2011 PECS (PCBS, 2014c) includes household income from government aid. Subsequently, the total income received by households from government transfers is calculated for each household group and is used as a starting value.

(7, N) Transfers to households from abroad

First, the share of remittances received from each of the seven foreign regions is derived from the bilateral remittance estimate for 2013 (World Bank, 2015). Second, the initial values for remittances received by individual household group are derived from the 2011 PECS (PCBS, 2014c).

(8, N) Transfers to NPISH from abroad

The value of donations to NPISH from each of the seven foreign regions is computed based on their respective shares in donations to the UN Relief and Works Agency for Palestine Refugees (UNRWA).

(9, E) Enterprise income from capital

The returns from capital to corporate enterprises is a one-to-one transaction between the accounts “Enterprise” and “Capital”. Therefore, the value of this transaction is identical in the macro and detailed SAMs.

(9, J) Transfers to enterprises by government

The value of subsidies transferred by the government to private enterprises is a one-to-one transaction between institutions “Enterprise” and “Government”. The value of this transaction is identical to that of the macro-SAM.

(10, I) Investment profit accruing to government

The total value of dividends received by the government from fully or partially state-owned enterprises is a one-to-one transaction between institutions “Government” and “Enterprise”. Hence, the value of this transaction is the same as in the macro-SAM.

(10, K) Direct tax revenue

Direct tax revenue received by the government includes the factor income tax (11, D), income tax on households (11, G) and corporate tax on enterprises (11, I). These are one-to-one transactions between the respective accounts and institution “Government”. Their values are identical in the macro and detailed SAMs.

(10, L) Indirect tax revenue

This includes the commodity and activity taxes. Commodity taxes (12, A) and activity taxes (12, C) taxes. These are also one-to-one transactions between the respective accounts and institution “Government”.

(10, N) Foreign grants

The shares of foreign grants received from the seven foreign regions stems from the Ministry of Finance report on fiscal operations (MoF, 2012c).

(11, D) Factor income tax

Initial values for tax on payroll levied on West Bank workers employed in the Israeli labour market is derived from the 2011 LFS (PCBS, 2014d). Workers employed in registered businesses in Israel are sorted by labour group and the total income by labour group is used as the initial value, under the assumption that the tax paid is a fixed share of the wage.

(11, G) Income and property tax

The matrix for property tax paid by each household group stems from the 2011 PECS (PCBS, 2014c). Income tax on households also stems from the 2011 PECS (PCBS, 2014c). As the survey does not provide explicitly for income tax, the proxy used is household total income as income tax is proportional to the total household income.

(11, H) Corporate tax

This is a one-to-one transaction between institution “Enterprise” and the tax account “direct tax”. Its value in the macro and detailed SAMs is identical.

(12, A) Commodity taxes

They encompass the following tax instruments: value added tax (VAT), excise and import taxes. The initial values for the VAT revenue are based on the SUT (PCBS, 2014a). The excise duty revenue in 2011 is derived from the Ministry of Finance fiscal development and macro performance report (MoF, 2012a). The import tax revenue is split according to the origin of import. Some adjustments were required. First, the import taxes are composed of customs duties and value added tax on import. Their respective total values stem from the NA (PCBS, 2014b) and the share of tax on import from Israel in these values stem from the Ministry of Finance fiscal development and macro performance report (MoF, 2012a).

The value added tax is applied to all import of goods regardless of the origin. Hence, the relative shares of import by origin and by good is used as proxies to derive the starting values for the matrix of value added tax on imports. As for the customs duties, the economic agreement between Israel and the Palestine provides for duty-free import and export between the two partners. However, since most of the petroleum import to the West Bank is actually a re-export from Israel, the agreement provides for Israel to transfer some of the customs duties levied on petroleum products to the PNA (UNCTAD, 2012).

Except for Israel, customs duties are fully levied on imports from the other foreign regions according to the existence of trade agreements. To determine the tariff revenue collected on each commodity group and according to the origin of the imports, the most recent Israeli tariff book is used (WTO, 2016). The Israeli tariff book is also used in Palestine, since the two partners form a customs union. From the tariff book, the tariff rates by commodity and for each foreign region is estimated.

Both Palestine and Israel have trade agreements with the USA, EU-28, EFTA, Turkey, and Jordan. Hence, for these regions, the tariff rates specified along the trade agreements are used. Only Palestine has a trade agreement with GAFTA countries. Since Jordan also belongs to the GAFTA, the same tariff rates are used for Jordan and GAFTA countries. For the region "rest of the world", the Most-favoured-nation (MFN) rates are used. Then, the estimated rates are applied to the import value by commodity and by origin so as to arrive at the starting values for the tariff revenue. Finally, the starting values for the tariff revenue and for the value added tax on import are summed up to arrive at the initial values for the import tax revenue by commodity group and by origin of import.

(12, C) Production and factor use taxes

For the production tax, the initial values are derived from the SUT (PCBS, 2014a). The factor use tax is disaggregated to generate for each labour category a factor use tax account. The initial values for the factor use tax matrix is derived from the 2011 LFS (PCBS, 2014d). First, workers employed in registered firms are selected, as registered firms are likely to pay taxes. Next, the workers are sorted by labour category and by the productive sectors employing them. Assuming that the factor use tax is a fixed share of wages received by the workers, total labour income is calculated for each labour group and is used as initial value for the matrix.

(13, E) Depreciation

Depreciation is a one-to-one transaction between the accounts "Capital" and "Investment-Savings". Its value is identical in the macro and detailed SAMs.

(13, G) Household savings

The initial values for household savings are computed from the 2011 PECS (PCBS, 2014c), by subtracting for each household group the total expenditure from total income.

(13, I) Enterprise savings

Enterprise savings is a one-to-one transaction between institution "Enterprise" and "Investment-Savings" account. Its value is the same in the macro and detailed SAMs.

(13, J) Government savings

Government savings is a one-to-one transaction between the institution "Government" and the "Investment-Savings" account. Its value is identical in the macro and detailed SAMs.

(12, N) Current account balance

The current account balance is estimated for each of the foreign regions as a residual in their respective accounts.

(14, A) Imports from Israel

Initial data on import of goods by origin is derived from the UN Comtrade database (UN Contrade, 2016). Goods in this database are listed according to the Harmonised System (HS) classification. Therefore, a concordance table between the HS classification and the 83 SAM commodity accounts is first established.

Next, Palestinian import of goods from the seven regions considered in the SAM is derived. Since most of the import from Israel actually go to the West Bank, the shares resulting from the UN Comtrade are adjusted for all Palestinian imports. Based on the share of the West Bank in the total clearance revenue related to import tax being transferred by Israel to the PNA (Kock and Qassis, 2011), that was about 95% in 2011, the share of total Palestinian import value from Israel that actually accrues to the West Bank is estimated. Then, the relative shares of the other regions in the remaining of the Palestinian import of goods are applied to the West Bank total import of goods derived from the NA (PCBS, 2014b), after excluding the imputed import value from Israel, so as to arrive at the import values from the other six regions.

As for services, the total value of West Bank import also stems from the NA (PCBS, 2014b). The disaggregated Palestinian import of services according to the extended balance of payments services classification (EBOPS) is derived from UN Comtrade database (UN

Contrade, 2016). Firstly, a mapping between the EBOPS and the SAM commodity classification is established. Secondly, the split of the total value of import of services across the seven foreign regions is conducted based on the outbound visitors survey (PCBS, 2013), complemented with PCBS experts' assumptions.

(14, D) Labour compensation to abroad

The value in the corresponding entry in the macro-SAM is assigned as a payment from the labour group "foreign workers" to the seven foreign regions. The split across the foreign regions is conducted based on their respective shares in the total foreign direct investment received by Palestine (PCBS, 2016d), assuming that the foreign investors will also export to Palestine their domestic labour.

(14, E) Capital payment to abroad

The value in the corresponding entry of the macro-SAM is split across the seven foreign regions based on their respective shares in the foreign direct investment made by Palestinian residents abroad (PCBS, 2016d).

(14, G) Household transfers to abroad

The value of transfers made by each household stems from the 2011 PECS (PCBS, 2014c). Households are sorted by household group and the total value of transfers they make is calculated and is used as the starting value.

Appendix 4. Elasticities used in the price systems (Armington and CET elasticities)

	Elasticity names (confer Figure 9-1)							
Commodity groups in the SAM	σ1	σ2	σ3.1	σ3.2	Ω1	Ω2	Ω3.1	Ω3.2
Olives	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Cereals, other crops	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Fruits, nuts and flowers	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Vegetables, horticultural specialties	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Animals	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Milk	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Forestry products	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Fishery products	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Stone, sand, clay	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Meat, meat products	1.58	1.2	3.2	3.2	2.0	1.2	4.0	4.0
Fish, fish products	1.58	1.2	3.2	3.2	2.0	1.2	4.0	4.0
Processed fruits, vegetables	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Oils, fats	1.436	1.2	2.9	2.9	2.0	1.2	4.0	4.0
Other food	1.745	1.2	3.5	3.5	2.0	1.2	4.0	4.0
Beverages	3.342	1.2	6.7	6.7	2.0	1.2	4.0	4.0
Clothing	1.335	1.2	2.7	2.7	2.0	1.2	4.0	4.0
Wood, wood products	3.195	1.2	6.4	6.4	2.0	1.2	4.0	4.0
Paper, paper products	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Coke, petroleum products	1.079	1.2	2.2	2.2	2.0	1.2	4.0	4.0
Other chemical products	4.834	1.2	9.7	9.7	2.0	1.2	4.0	4.0
Other manufacturing	1.463	1.2	2.9	2.9	2.0	1.2	4.0	4.0
Electricity, gas	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Water	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Construction	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Wholesale	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Repair of household goods	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Retail sale	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Hotels	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Restaurants	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Transport	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
National post activities	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Communication	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Finance and auxiliary services	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Business activities	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Public administration, defence	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Education	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Health, social work	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0
Other services	2.2	1.2	4.4	4.4	2.0	1.2	4.0	4.0

Appendix 5. Elasticities used in the production module

Elasticity names (confer Figure 9-2)	
σ_1 CES for output	0.5
σ_2 CES for value added	0.8
σ_3 CES for labour	1.1
σ_4 CES for domestic labour	1.3
σ_5 CES for low and high-skilled labour	1.5
σ_6 CES for male labour	1.8

Appendix 6. Income demand elasticities

	Quintile 1 households	Quintile 2 households	Quintile 3 households	Quintile 4 households	Quintile 5 household s
Olives	0.4	0.3	0.2	0.1	0.05
Cereals, other crops	0.4	0.3	0.2	0.1	0.05
Fruits, nuts and flowers	0.4	0.3	0.2	0.1	0.05
Vegetables	0.4	0.3	0.2	0.1	0.05
Animals	0.6	0.5	0.4	0.3	0.2
Milk	0.6	0.5	0.4	0.3	0.2
Forestry products	0.4	0.3	0.2	0.1	0.05
Fishery products	0.6	0.5	0.4	0.3	0.2
Stone, sand, clay	0.6	0.6	0.6	0.6	0.6
Meat, meat products	0.6	0.6	0.6	0.6	0.6
Fish, fish products	0.6	0.6	0.6	0.6	0.6
Processed fruits, vegetables	0.8	0.65	0.45	0.35	0.25
Oils, fats	0.8	0.65	0.45	0.35	0.25
Other food	0.4	0.3	0.2	0.1	0.05
Beverages	0.8	0.65	0.45	0.35	0.25
Clothing	1.2	1.2	1.2	1.2	1.2
Wood, wood products	1.2	1.2	1.2	1.2	1.2
Paper, paper products	1.2	1.2	1.2	1.2	1.2
Coke, petroleum products	1.2	1.2	1.2	1.2	1.2
Other chemical products	1.4	1.4	1.4	1.4	1.4
Other manufacturing	1.6	1.6	1.6	1.6	1.6
Electricity, gas	2	2	2	2	2
Water	2	2	2	2	2
Construction	1.2	1.2	1.2	1.2	1.2
Wholesale	1.5	1.5	1.5	1.5	1.5
Repair of household goods	1.5	1.5	1.5	1.5	1.5
Retail sale	1.5	1.5	1.5	1.5	1.5
Hotels	1.5	1.5	1.5	1.5	1.5
Restaurants	1.5	1.5	1.5	1.5	1.5

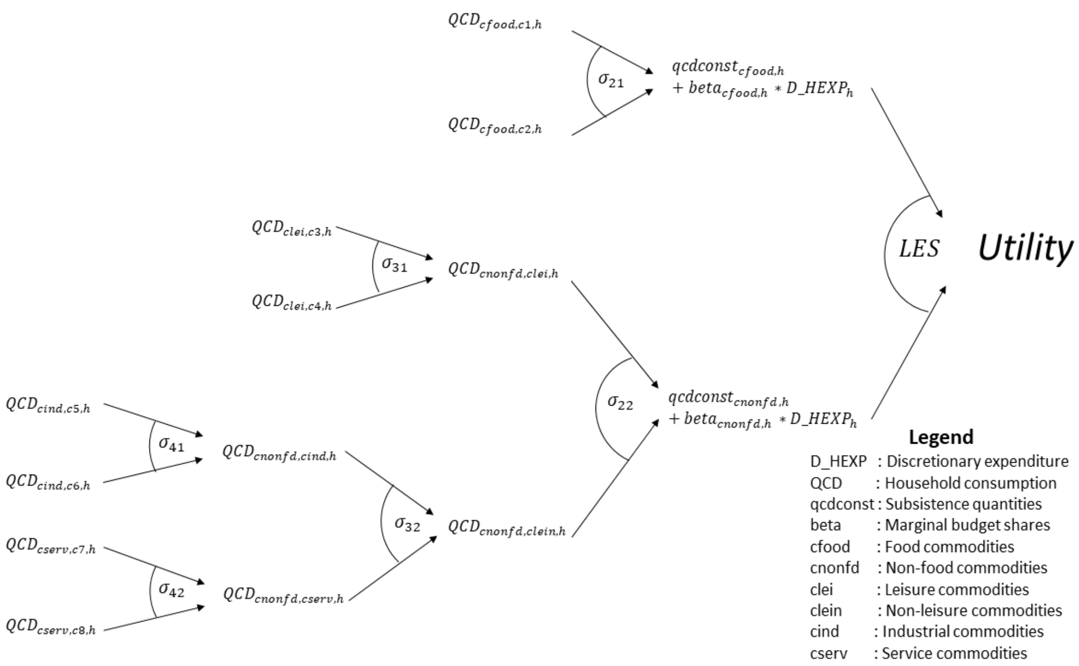
Transport	1.5	1.5	1.5	1.5	1.5
National post activities	1.5	1.5	1.5	1.5	1.5
Communication	1.5	1.5	1.5	1.5	1.5
Finance services	1.5	1.5	1.5	1.5	1.5
Business activities	2.2	2.2	2.2	2.2	2.2
Public administration, defence	2.2	2.2	2.2	2.2	2.2
Education	2.2	2.2	2.2	2.2	2.2
Health, social work	2.2	2.2	2.2	2.2	2.2
Other services	2.2	2.2	2.2	2.2	2.2

Appendix 7. Shares of imports in total supply and exports in domestic output

	Import in total supply	Export in domestic output
Agricultural products	37.9	10.1
Food products	46.4	15.6
Industrial products	82.7	51.3
Services	12.2	3.2
All commodities	36.3	11.1

Source: West Bank SAM

Appendix 8. Nested utility function for sensitivity analysis



Appendix 9. In-quota and out-of-quota tariffs in Palestine by commodity group and trade partner (in %)

		In-quota tariff rates							Out-of-quota tariff rates						
		Israel	USA	EU-28 + EFTA	Turkey	Jordan	GAFTA	Rest of the world	Israel	USA	EU-28 + EFTA	Turkey	Jordan	GAFTA	Rest of the world
Agricultural products	Olives	0	0	0	0	0	0	37	0	65	127	127	127	127	127
	Cereals	0	0	0	0	0	0	33	0	118	118	118	118	118	118
	Fruits	0	0	2	0	0	0	40	0	139	171	234	60	60	260
	Vegetables	0	0	0	0	0	1	60	0	304	344	384	105	105	469
	Milk	0	0	0	0	0	0	0	0	153	153	153	153	153	153
	Animals	0	0	0	0	0	0	22	0	85	99	142	138	138	238
	Fish	0	0	0	0	0	0	0	0	85	99	142	138	138	238
	Forest products	0	0	0	0	0	0	20	0	170	170	170	170	170	170
Food products	Meat and dairy products	0	0	15	38	17	0	35	0	109	102	105	105	105	109
	Fish products	0	0	0	0	0	0	32	0	109	102	105	105	105	109
	Processed fruits and vegetables	0	29	18	52	58	0	60	0	133	133	133	133	133	133
	Oils and fats	0	18	1	34	0	6	44	0	80	80	80	80	80	80
	Other food products	0	29	6	34	29	8	73	0	92	114	94	101	101	153
	Beverages	0	0	0	0	9	50	45	0	134	134	134	134	134	134

		In-quota tariff rates							Out-of-quota tariff rates						
		Israel	USA	EU-28 + EFTA	Turkey	Jordan	GAFTA	Rest of the world	Israel	USA	EU-28 + EFTA	Turkey	Jordan	GAFTA	Rest of the world
Industrial products	Mining products	0	0	0	0	0	0	45							
	Textile and leather products	0	0	0	0	4	1	43							
	Wood products	0	0	0	0	0	0	40							
	Paper and publishing products	0	0	0	0	0	1	36							
	Coke and petroleum products	52	0	0	0	0	0	52							
	Chemical and plastic products	0	0	0	0	0	0	63							
	Other manufactured products	0	0	0	0	0	0	74							

Appendix 10. Estimated[26] import quotas in the West Bank (in thousands US$)

		Israel	USA	EU-28 + EFTA	Turkey	Jordan	GAFTA	Rest of the world
Agricultural products	Olives	0	0	0	0	0	0	0
	Cereals	170	3	3	1	0	1	11
	Fruits	66	0	1	1	1	0	13
	Vegetables	9	1	1	0	0	0	1
	Milk	10	0	0	0	0	0	0
	Animals	118	1	0	0	0	0	0
	Fish	1	0	0	0	0	0	0
	Forest products	3	0	0	0	0	0	0
	Sub-total	376	4	6	3	1	2	25
Food products	Meat and dairy products	217	0	5	0	0	0	6
	Fish products	12	0	0	0	0	0	5
	Processed fruits and vegetables	27	1	1	1	3	4	6
	Oils and fats	8	2	2	4	0	2	4
	Other food products	204	2	42	30	5	14	24
	Beverages	88	0	7	3	6	8	0
	Sub-total	555	5	58	39	14	29	46

[26] Estimation based on PCBS expert judgement that import quotas are roughly 20% higher than observed import values.

Appendix 11. Composition of household income (in %)

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	All households
Labour	77.7	77.1	74.8	63.5	47.8	64.0
Capital	7.2	11.2	15.7	25.6	33.8	22.4
Land	0.0	0.0	0.0	0.0	0.0	0.0
Inter-household transfers	1.3	0.8	0.8	0.7	0.7	0.8
Transfers from non-profit organisations	0.3	0.2	0.1	0.1	0.0	0.1
Government transfers	10.3	7.6	4.3	6.4	8.4	7.3
Remittances	3.3	3.2	4.3	3.8	9.2	5.5
Total	100	100	100	100	100	100

Source: West Bank SAM

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